August 31, 2020

***Anderson et al. v. Raffensperger et al.*, Case No. 1:20-cv-03263-MLB**

United States District Court for the
Northern District of Georgia

Expert Report of Jonathan Rodden, PhD

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I. INTRODUCTION AND SUMMARY

I have been asked by Plaintiffs in this case to assess the costs associated with long lines at polling places in Georgia elections. Specifically, I have been asked to first convey the most important insights from the academic literature on the costs and benefits of voting, with special attention to the problem of long lines for in-person voting, and then, to examine the extent to which these insights apply to the experience of Georgia voters in recent years. My analysis of the long lines addresses three questions inspired by the broader literature: First, to what extent has the burden of long lines fallen disproportionately on minority communities? Second, to what extend does the structure of polling places and precincts appear to have been responsible for the problem? Third, is there evidence that long lines have a discernable impact on turnout and confidence in elections? My key conclusions are as follows:

1. Long lines were concentrated in the Atlanta-area counties of Cobb, Clayton, Douglas, DeKalb, Forsyth, Fulton, Gwinnett, and Henry. Outside of Atlanta, the problems were concentrated in Chatham County, and to a lesser extent in Muscogee and Ware counties.
2. Consistent with other studies of Georgia and beyond, and consistent with prior experience in Georgia, long lines on June 9, 2020 were disproportionately experienced by minority voters.

- Among polling places where *minorities* made up over 90 percent of registered voters, 36 percent were forced to stay open over one hour past the specified closing time in order to accommodate long lines. In the Atlanta metro area, 45 percent of such polling places were forced to do so. Among polling places where *whites* made up over 90 percent of registered voters, less than 3 percent of polling places were required to stay open late in order to accommodate long lines.
- In polling places where minorities constituted more than 90 percent of active registered voters, the average minimum wait time in the evening was 51 minutes. When whites constituted more than 90 percent of registered voters, the average was around six minutes.
- Several metrics indicate that the prevalence of relatively serious polling place difficulties was more than three times greater in majority-minority polling places than in majority-white polling places.

3. Over the last decade, Georgia's population has grown substantially—especially in the Atlanta metro area—while the number of polling places has not expanded. As a result, Georgia's polling places serve unusually large numbers of voters, especially in minority communities. Problems with long lines were experienced disproportionately at polling places with large numbers of voters, especially those that serve multiple precincts.

- Of the 242 polling places that were still checking in voters at 8 PM, 227 (94 percent) served numbers of active registered voters above the national average of 1,547, and 203 (84 percent) were above the Georgia median of 2,646 active registered voters. The vast majority of these troubled polling places were in the Atlanta metro area (83 percent).
- Across all polling places in the State, the average minimum evening wait time was around four minutes for all of the precincts at or below the national average size of 1,547. For those above the statewide median, it was around 27 minutes. For those with more than 5,000 active voters, it was around 50 minutes.
- Polling locations that served multiple precincts rather than a single precinct clearly accounted for a large part of the problem in the June 2020 Primary. Only 7 percent of the polling places that served a single precinct checked in voters after 8 PM, whereas of those serving multiple precincts, 52 percent did so. The average minimum wait time after 7 PM was around 12 minutes in single-precinct polling places, but it was one hour and nine minutes in the polling places that served multiple precincts.

4. Minorities are more likely to live in polling places serving unusually large numbers of voters, especially in metro Atlanta, and more likely to live in polling places that serve multiple precincts.
5. Minority voters are far less likely than whites to make use of absentee voting, which places greater pressure on in-person voting locations in minority communities.
6. Minority voters are between three and four times more likely than whites to cast provisional ballots. Confusion surrounding provisional ballots can contribute to slowdowns at polling places.
7. Of all those who chose a Democratic ballot in the June 2020 Primary, 22 percent lived in neighborhoods assigned to polling places that were open past 8 PM, while 7.2 percent of those choosing a Republican ballot lived in such neighborhoods. Of those who lived in neighborhoods where the polling place was open past 8 PM, 75.4 percent voted in the Democratic Primary, while 21.7 percent voted in the Republican Primary.
8. Academic studies have found evidence that long lines lead to lower turnout both in effected election and in future elections, as well as a loss of voter confidence in elections. Consistent with these studies, I find:
    - Turnout was lower by 2 percentage points in precincts that were open late relative to those that were not, and turnout was lower by five

percentage points in precincts that experienced wait times of over 50 minutes than in precincts that experienced a wait time of less than five minutes.

- In individual-level models that control for a host of demographic and geographic factors, the negative impact on turnout of living in a precinct with long lines was around 1.3 percentage points overall, and 2 percentage points in the Atlanta metro area.
- If we focus only on those with a past history of voting in primaries, the effect on turnout of living in a precinct with long lines is substantially larger: 2.9 percentage points in the state as a whole, 3.8 percentage points in metro Atlanta, and 1.9 percentage points outside of Atlanta.

II. QUALIFICATIONS

I am currently a tenured Professor of Political Science at Stanford University and the founder and director of the Stanford Spatial Social Science Lab ("the Lab")—a center for research and teaching with a focus on the analysis of geo-spatial data in the social sciences. In my affiliation with the Lab, I am engaged in a variety of research projects involving large, fine-grained geo-spatial data sets including ballots and election results at the level of polling places, individual records of registered voters, census data, and survey responses. Prior to my employment at Stanford, I was the Ford Professor of Political Science at the Massachusetts Institute

of Technology. I received my Ph.D. from Yale University and my B.A. from the University of Michigan, Ann Arbor, both in political science. A copy of my current C.V. is included as an Appendix to this report.

In my current academic work, I conduct research on the relationship between the patterns of political representation, geographic location of demographic and partisan groups, and the drawing of electoral districts. I have published papers using statistical methods to assess political geography, balloting, and representation in a variety of academic journals including *Proceedings of the National Academy of Science*, *American Economic Review Papers and Proceedings*, the *Journal of Economic Perspectives*, the *Virginia Law Review*, the *American Journal of Political Science*, the *British Journal of Political Science*, the *Annual Review of Political Science*, and the *Journal of Politics.* One of these papers was recently selected by the American Political Science Association as the winner of the Michael Wallerstein Award for the best paper on political economy published in the last year, and another received an award from the American Political Science Association section on social networks.

I have recently written a series of papers, along with my co-authors, using automated redistricting algorithms to assess partisan gerrymandering. This work has been published in the *Quarterly Journal of Political Science*, *Election Law Journal*, and *Political Analysis*, and it has been featured in more popular publications like the

Wall Street Journal, the *New York Times*, and *Boston Review*. I have recently completed a book, published by *Basic Books* in June of 2019, on the relationship between political districts, the residential geography of social groups, and their political representation in the United States and other countries that use winner-take-all electoral districts. The book was reviewed in *The New York Times, The New York Review of Books, Wall Street Journal, The Economist,* and *The Atlantic*, among others.

I have expertise in the use of large data sets and geographic information systems (GIS), and conduct research and teaching in the area of applied statistics related to elections. My PhD students frequently take academic and private sector jobs as statisticians and data scientists. I frequently work with geo-coded voter files and other large administrative data sets, including in recent paper published in the *Annals of Internal Medicine* and *The New England Journal of Medicine.* I have developed a national data set of geo-coded precinct-level election results that has been used extensively in policy-oriented research related to redistricting and representation.[1]

I have been accepted and testified as an expert witness in six recent election law cases: *Romo v. Detzner*, No. 2012-CA-000412 (Fla. Cir. Ct. 2012); *Mo. State*

[1] The dataset can be downloaded at http://projects.iq.harvard.edu/eda/home. The data can be visualized in an interactive web map, available at http://atlas.esri.com/Atlas/VoterAtlas.html.

Conference of the NAACP v. *Ferguson-Florissant Sch. Dist.*, No. 4:2014-CV-02077 (E.D. Mo. 2014); *Lee v. Va. State Bd. of Elections*, No. 3:15-CV-00357 (E.D. Va. 2015); *Democratic Nat'l Committee et al. v. Hobbs et al.*, No. 16-1065-PHX-DLR (D. Ariz. 2016); *Bethune-Hill v. Virginia State Board of Elections*, No. 3:14-cv-00852-REP-AWA-BMK (E.D. Va. 2014); and *Jacobson et al. v. Lee*, No. 4:18-cv-00262 (N.D. Fla. 2018). In addition, I recently submitted written testimony in *League of Women Voters of Florida v. Detzner*, No. 4:18-cv-002510 (N.D. Fla. 2018) and *College Democrats at the University of Michigan, et al. v. Johnson et al.*, No. 3:2018-cv-12722 (E.D. Mich. 2018). I also worked with a coalition of academics to file Amicus Briefs in the Supreme Court in *Gill v. Whitford*, No. 16-1161, and *Rucho v. Common Cause*, No. 18-422. Much of the testimony in these cases had to do with geography, voting, ballots, and election administration. I am being compensated at the rate of $500/hour for my work in this case. My compensation is not dependent upon my conclusions in any way.

III. DATA SOURCES

This report draws on data from a number of sources. In addition to a review of the academic and public policy literatures on long lines, I have drawn on a variety of sources specific to Georgia. First, I created a large individual-level data set,

building on an extract of the Georgia voter file dated April 7, 2020.[2] I merged this file together with the vote history file[3] as well as the individual-level absentee voting file from the June 2020 Primary Election.[4]

Additionally, I have collected data on the polling places used in the June 9, 2020 election. Stephen Fowler, a reporter for Georgia Public Broadcasting, has assembled a complete list of polling places and associated precincts used in the June 2020 Primary. He has also obtained spreadsheets sent by the Georgia Secretary of State to individual counties including information from e-pollbooks about check-ins each hour in each precinct. All of this information at the level of individual polling places has been merged with demographic information from the voter file. Mr. Fowler has made the data publicly available.[5] I used Google Maps to geocode and map these polling places.

In order to gain an understanding of long lines in previous elections, I used Lexis-Nexis to search for news reports in the Atlanta Journal-Constitution as well as national media sources.

Finally, in order to create visualizations, I collected data on race and population from the American Community Survey for various years. These data,

[2] This file was provided to me by Counsel, and it is my understanding that it was purchased from a data firm called L2.
[3] https://sos.ga.gov/index.php/elections/voter_history_files
[4] https://elections.sos.ga.gov/Elections/voterabsenteefile.do
[5] https://public.tableau.com/profile/stephen.fowler#!/vizhome/GeorgiaPollsOpenClose69/GA69PollsOpenClose

along with accompanying geographic boundary files at the level of census block groups, were downloaded from Simply Analytics (via the Stanford Library System) and the National Historical Geographic Information System (NHGIS).

IV. LONG LINES, THE COST OF VOTING, AND TURNOUT

The academic literature on long lines is a subset of a larger literature on the costs and benefits of voting.[6] In this literature, there is broad agreement that turnout behavior is driven by a mix of individual-level costs—like keeping one's registration up to date after a residential move, waiting in line, procuring a valid form of identification, or gathering information about the location of the correct polling place—as well as benefits, like contributing to the victory of a desired candidate, or feeling a sense of pride or civic engagement. A key insight in this literature is that anything that increases the cost of voting—like waiting for hours in the sun to vote—decreases the likelihood of voting. And in study after study, it is clear that poor minorities in the United States are often those most subjected to increased costs of voting, but also those most sensitive to those increased costs.[7]

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[6] William Riker and Peter C. Ordeshook. 1968. "A Theory of the Calculus of Voting." *American Political Science Review* 62:25-42; John Aldrich. 1993. "Rational Choice and Turnout." *American Journal of Political Science* 37:246-278; André Blais, Jean-François Daoust, Ruth Dassonneville, and Gabrielle Péloquin-Skulski. 2019. "What is the Cost of Voting?" *Electoral Studies* 59:145-157; David Darmofal. 2010. "Reexamining the Calculus of Voting." *Political Psychology* 31:149-174.

[7] Jan E. Leighley and Jonathan Nagler. 2014. *Who Votes Now? Demographics, Issues, Inequality, and Turnout in the United States.* Princeton: Princeton University Press; Christopher Ojeda, Christopher. 2018. "The Two Income-Participation Gaps." *American Journal of Political Science* 62:813-829; Steven Rosenstone. 1982. "Economic Adversity and Voter Turnout." *American*

In recent years, it has become clear that long lines on Election Day impose a significant cost of voting in a number of jurisdictions around the United States, even as increasing numbers of voters cast their votes early or via absentee ballots. From the 2014 Mid-term to the 2018 Mid-term, for example, the percentage of voters reporting that they waited more than 30 minutes to cast their ballot has doubled.[8] An innovative, comprehensive study of the problem in the 2018 Mid-term by the Bipartisan Policy Center and MIT revealed that the problem varies a great deal from one jurisdiction to another.[9] This study identified Georgia as the state with the longest wait times in the United States.

While it may be tempting to interpret long lines on Election Day as a sign of voter enthusiasm, these lines can have substantial costs. Above all, voters who encounter long lines on Election Day are less likely to vote, both in the current election and in the future. In a recent study of the 2016 election, teams of researchers fanned out across polling places around the country with timers, documenting wait times, line length, and recording instances in which voters left without voting after waiting in line for a period of time.[10] They discovered that around three percent of

Journal of Political Science 26:25-46; Steven Rosenstone, S.J. and Raymond Wolfinger. 1978. "The Effect of Registration Laws on Voter Turnout," *American Political Science Review* 72(45).

[8] Matthew Weil, Charles Stewart, Tim Harper, and Christopher Thomas, *The 2018 Voting Experience: Polling Place Lines.* Bipartisan Policy Center, November 2019.

[9] Weil et al., *op. cit.*

[10] Robert Stein et al., "Waiting to Vote in the 2016 Presidential Election: Evidence from a Multi-

those who got in line at a polling place ended up not voting in 2016, and established that as one would expect, the number of voters who left without voting was higher in precincts with longer lines. A study of Franklin County, Ohio in the 2004 general election documented a correlation between a lack of voting machines, longer lines, and lower turnout.[11]

Responses to the 2016 Voting and Registration Supplement of the Current Population Survey indicate that over 560,000 eligible voters failed to cast a ballot in the November 2016 General Election because of long lines and other polling place management failures. The figure was around 500,000 eligible voters in the November 2012 survey. According to research by Stephen Pettigrew, the impact of long lines on turnout is not only felt in the election when the long lines are experienced, but in subsequent elections as well. He demonstrates that for every additional hour a voter waits in line to vote, their probability of voting in the subsequent election drops by one percentage point. Substantively, he estimates that 200,000 people did not vote in 2014 because they were deterred by long lines experienced in 2012.[12] In the long run, Pettigrew finds that asymmetries in wait

County Study." *Political Research Quarterly* 73(2): 439-453, June 2020.

[11] Benjamin Highton, "Long Lines, Voting Machine Availability, and Turnout: The Case of Franklin County, Ohio in the 2004 Presidential Election," *PS: Political Science and Politics* 39(1): 65-58, January 2006.

[12] Stephen Pettigrew, *The Downstream Consequences of Long Waits: How Lines at the Precinct Depress Future Turnout*, working paper, University of Pennsylvania, 2020.

times across racial groups is part of the explanation for the persistent gap in turnout between whites and minorities.[13]

Even when resolute voters stay in line to cast their ballots, long lines impose monetary costs on voters from missed work, extra child care costs, and lost productivity. According to Charles Stewart and Stephen Ansolabehere, a back-of-the envelope estimate of monetary costs can be achieved by multiplying the total number or hours waiting in line by average hourly earnings, which came to $544 million in 2012—a figure that has only grown as lines have grown longer over time.[14]

Moreover, long lines undermine voters' confidence in elections. Respondents to the Survey of the Performance of American Elections (SPAE) indicate that among Election Day voters in 2012, 68 percent of those who waited ten minutes or less to vote stated that they were "very confident" that their vote was counted as intended, compared with only 47 percent for those who waited over an hour. Those who waited in long lines lost confidence in the counting not only of their own vote, but of the legitimacy of the vote-counting in the United States more broadly.[15] This is part of

[13] Pettigrew, 2020, *op cit.*
[14] Charles Stewart and Stephen Ansolabehere, "Waiting to Vote," *Election Law Journal*, 14(1): 47-53, 2015.
[15] Charles Stewart and and Stephen Ansolabehere. 2013. *Waiting in Line to Vote*. Caltech/MIT VTP Working Paper # 114.

a broader literature establishing that failures of election administration have a significant negative impact on voters' confidence in American elections.[16]

Research on long lines has also revealed clear disparities in the incidence of long lines. In study after study, it is clear that long lines are more common at polling places with large concentrations of minorities, in urban areas, and in poor neighborhoods.[17] The most recent survey-based estimates come from respondents to the 2018 Cooperative Congressional Election Study (CCES), where African American and Hispanic voters reported waiting 32 percent longer, on average, than white voters, and residents of the most densely populated neighborhoods reported waiting 25 percent longer than residents of the least densely populated neighborhoods. The massive study of actual precinct-level wait times in 2018 carried out by the Bipartisan Policy Center and the Massachusetts Institute of Technology, mentioned above, showed that average wait times in precincts with a minority population between zero and 10 percent were around 5 minutes, while average wait

[16] See, for instance, Lonna Rae Atkeson and Kyle Saunders, "The Effect of Election Administration on Voter Confidence: A Local Matter?" *PS: Political Science and Politics* 40(4): 655-660; Michael Alvarez, Thad Hall, and Morgan Llewellyn, "Are Americans Confident their Ballots are Counted?," *Journal of Politics*, vol. 70, pp. 754–766, July 2008; Shaun Bowler, Thomas Brunell, Todd Donovan, and Paul Gronke, "Election Administration and Perceptions of Fair Elections," *Electoral Studies*, vol. 38, pp. 1–9, June 2015.

[17] Stewart and Ansolabehere 2013, *op cit.*; Stewart and Ansolabehere 2015, *op cit.*; Weil et al. 2019, *op cit.*; Stephen Pettigrew, "The Racial Gap in Wait Times: Why Minority Precincts are Underserved by Local Election Officials," *Political Science Quarterly* 132(2): 527-547.; Stephen Pettigrew, "Long Lines and Voter Purges: The Logistics of Running Elections in America," PhD Dissertation, Harvard University, 2017; Robert Stein, Christopher Mann, and Charles Stewart, "Waiting to Vote in the 2016 Presidential Election: Evidence from a Multi-County Study," *Political Research Quarterly* March 2019; Stein et al. 2020, *op cit.*

times in precincts with minority populations between 90 and 100 percent were over 30 minutes.[18] Another innovative study used pings from millions of cell phones on Election Day in November of 2016 and other surrounding days, which allowed a group of researchers to estimate wait times at various polling locations around the country. They found that relative to white neighborhoods, residents of African-American neighborhoods waited 29 percent longer to vote and were 74 percent more likely to spend more than 30 minutes at their polling place.[19]

Moreover, confirming the results of survey research, the Bipartisan Policy Center/MIT study indicated that average wait times in precincts with average annual income greater than $100,000 were around 8.5 minutes, while wait times in precincts with average income between $20,000 and $30,000 were 23.4 minutes. Unfortunately, the populations most affected by wait times are those that can least afford to wait in line. Poor voters in urban neighborhoods often work as shift laborers with unpredictable and unforgiving work schedules and difficult child care arrangements.[20] For workers with precarious and unpredictable sources of income and strict policies regarding absences, waiting in line for hours to vote during the workday can lead to a serious loss of income or future employment opportunities.

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[18] Weil et al. 2019, *op cit.*, Figure 9 (page 21).

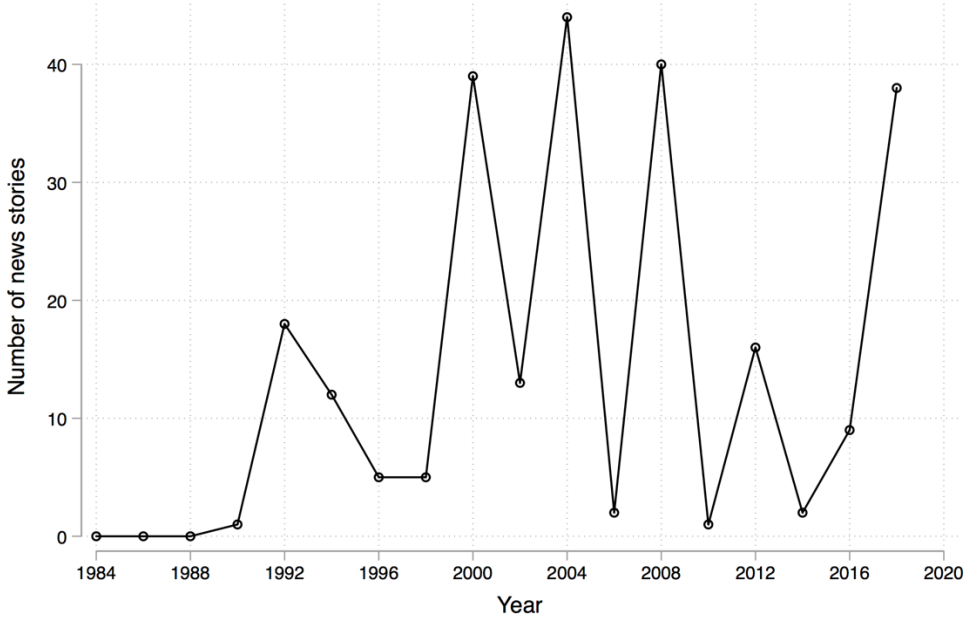
[19] M. Keith Chen, Kareem Haggag, Devin Pope, and Ryne Rohla, "Racial Disparities in Voting Wait Times: Evidence from Smartphone Data," *NBER Working Paper No. 26487*, November 2019.

[20] See Lonnie Gordon, "Irregular Work Scheduling and its Consequences," *Economic Policy Institute* Report, April 9, 2015.

V. LONG LINES IN GEORGIA: A COMPARATIVE AND HISTORICAL PERSPECTIVE

Georgia has featured heavily in media reporting on long lines at polling places for several election cycles, as well as in reports by advocacy groups, and more recently, in the burgeoning academic literature reviewed above. To get a sense for media coverage of long lines associated with elections in Georgia over time, using the Lexis-Nexis database, I have done a search for all stories in the Atlanta Journal-Constitution that contain the terms "Georgia" and "long lines" and "election." In order to include the early voting period as well as election coverage after each election, I have conducted this search for the period from August 1 of the year of each November election to August 1 of the following year. I have done this for general election years from 1984 to the present. The results are presented in Figure 1 below.

Figure 1: Number of Stories in the Atlanta Journal Constitution about Long Lines in Georgia Elections



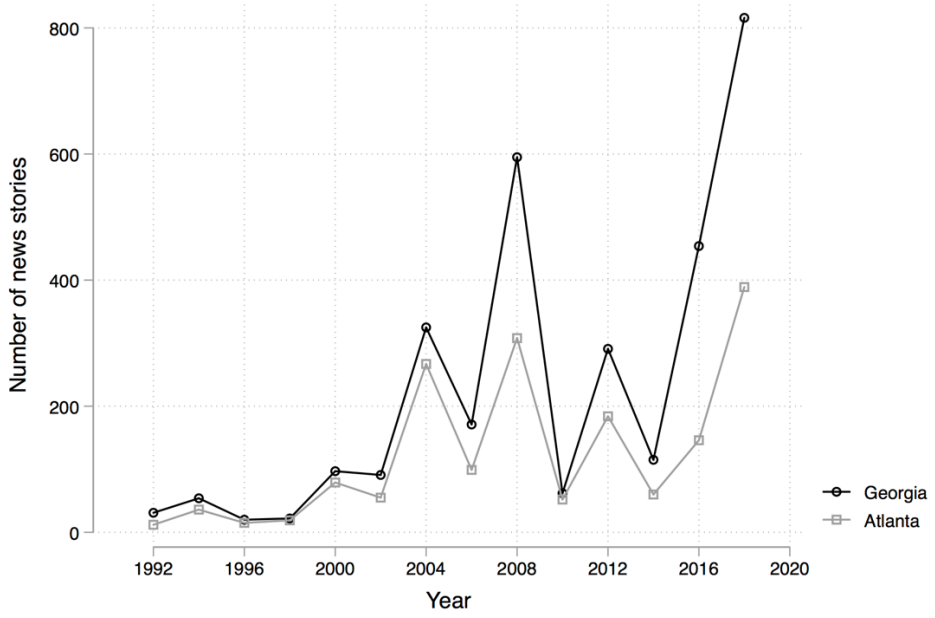
Coverage of long lines at polling places for Georgia elections are nothing new. There were no stories about long lines associated with elections in the Atlanta Journal Constitution in the 1980s. Turnout was very high in Georgia in 1992, and there were a handful of stories about parking problems and long lines on Election Day. Then, after a drop in 1996, starting in 2000, every presidential election year has seen a relatively large number of stories about long lines at polling places associated with Georgia elections. As Figure 1 shows, these stories are typically more frequent in presidential election years than in midterm years, although the reporting was more limited in the presidential year of 2016, and took off in Georgia's troubled 2018 midterm election.

The reports of Atlanta Journal-Constitution writers are surprisingly consistent from 2000 to the present. They describe angry voters, long lines snaking outside buildings, hours of waiting, and court orders to keep polling places open well past 7 PM—sometimes until after 10 PM. These stories focus almost exclusively on predominantly African-American precincts in the Atlanta metro area. For instance, a story published on November 8, 2000 interviewed Rep. John Lewis, who waited two hours to vote at Venetian Hills Elementary School, where the polling place opened 45 minutes late, and 7 of 13 voting machines were broken. Very long lines were reported in several other African-American neighborhoods, including the polling places of Dunwoody Springs Elementary School in Fulton County, Stoneview Elementary School in DeKalb County, E.W. Oliver Elementary School in Clayton County, and several precincts in Cobb County. The articles also mentioned difficulties in Gwinnett and Clayton Counties, and described the anger of voters who were still waiting in line when the television networks declared the winner of Georgia's electoral votes in the 2000 presidential race.

Such stories have become a regular feature of election reporting in presidential years since 2000. In addition to interviews with angry voters in the same minority neighborhoods in metro Atlanta, these stories typically feature interviews with election officials who express surprise about unanticipated levels of voter

enthusiasm and unexpected turnout. Starting in 2004, the national media also started paying attention to the problem of long lines for in-person voting in Georgia.

Figure 2: Number of Stories in Lexis-Nexis about Long Lines in Georgia Elections



To make Figure 2, I conduct the same search using *all* of the news sources in the Lexis-Nexis database, searching separately for "Georgia" and "Atlanta." Here as well, we see large spikes in stories about long lines in presidential election years, with an unusually large increase in 2018. These stories also focus primarily on African-American precincts in the Atlanta areas.

Beginning in 2004, advocacy groups started to collect information from poll observers and telephone hotlines. An October 2012 report sponsored by several election protection advocacy groups documented long lines and voting machine problems in the 2004 general election, and identified Clayton County as the

"epicenter" of the problem in that year.[21] The same report identified problems of overcrowding at polling places that were spread throughout the Atlanta region in the 2008 election, but with problems especially concentrated in Fulton County. In addition to Fulton and Clayton, media reporting focused on long lines in 2008 in Gwinnett, DeKalb, Cobb, and other Atlanta-area counties.[22]

Long lines were also reported in November 2012, most notably in Fulton County. Calls to an Election-Day Hotline revealed major failures with electronic poll books that led to "long lines, frustration, and thousands of eligible voters having to vote provisionally," so that "several polling places ran out of provisional ballots, and voters reported being turned away without being able to cast any type of ballot."[23] Voters at the polling place on the campus of Morehouse College reported standing in line for up to seven hours.[24]

Once again, media reports focused on long lines in the Atlanta area in the November 2016 general election, especially during the early voting period, with a

[21] Georgia Election Protection Leadership Committee, Georgia Appleseed Center for Law and Justice, and the Lawyers' Committee for Civil Rights Under Law, "Resolving Recurring Election Administration Problems in Georgia," October 2012.
[22] https://www.nbcdfw.com/news/politics/long_lines__glitches_greet_early_voters/1841895/; https://www.wqxr.org/story/5415-adaora-visits-crowded-atlanta-polling-place/?tab=summary; https://politicalticker.blogs.cnn.com/2008/10/31/unprecedented-wait-times-plague-georgia-voters/; https://www.facingsouth.org/2008/10/voting-rights-watch-long-lines-a-voting-rights-issue.html
[23] Lawyer's Committee for Civil Rights Under Law, "2012 Election Protection Report" (2013).
[24] Lawyer's Committee 2013, *op cit.*

number of stories focusing on Cobb, Gwinnett, Fulton, and DeKalb counties.[25] In 2018, as demonstrated in the graphs above, the problem with long lines in metro Atlanta received considerable national attention. Reports in 2018 focused especially on very long lines in Fulton, Gwinnett, and Cobb counties. In Fulton County, multiple precincts were assigned to Pittman Park Recreation Center, but it was evidently not supplied with corresponding equipment, leading to extremely long lines and another late night. Courts ordered polling places to stay open late not only at Pittman Park, but also at Booker T. Washington High School and once again at Morehouse College.[26] Some of the same communities featured consistently in reporting from previous years were in the news once again in 2018, including precincts in Snellville in Gwinnett County. Three precincts were forced to stay open late in Gwinnett. In Cobb County, lines between 1.5 and 2 hours were reported by voters at several locations.

Since one might worry about bias in reports of the news media or advocacy groups, it is useful to also examine the burgeoning survey literature on long lines.

[25]https://www.ajc.com/news/local/polls-open-cobb-county-long-lines-voters-with-many-opinions/tt5YCJlKJLL4j5lKszaRzO/; https://www.theguardian.com/commentisfree/2016/oct/19/early-voting-lines-georgia; https://patch.com/georgia/atlanta/georgia-election-results-2016-voters-greeted-long-lines-polling-locations; http://cp.wabe.org/post/some-gwinnett-county-voters-see-long-lines-polls; https://www.ajc.com/news/local/you-plan-voting-today-cobb-pack-your-patience/AHo7nPe9Ypq99YzMcFxqMI/

[26] https://www.propublica.org/article/georgia-voters-face-hours-long-waits-as-state-scrambles-to-accommodate-turnout

The Survey of the Performance of American Elections is a post-election survey of voters that was conducted for each general election by a group of researchers headed by the Massachusetts Institute of Technology. Some of the data can be visualized on a web page created by the Pew Charitable Trusts.[27] It includes a variety of questions about voters' experiences casting their ballots, including the time spent waiting in line. In the 2008 survey, Georgia had the second longest wait times in the United States. In 2012, Georgia was eighth in the country on this metric. In 2014, it was ranked fourth. In 2016, it was tied for second.[28]

In addition to the Survey of the Performance of American Elections, another valuable resource is the Cooperative Congressional Election Study (CCES), which has large samples within each U.S. state. Using CCES data, Georgia ranked sixth in wait times in 2012,[29] and seventh in 2014.[30] Using survey data from the 2018 CCES, a study by the Bipartisan Policy Center and MIT concluded that Georgia had the longest estimated wait times in the country in 2018.[31] The study also found that not only are Georgia's wait times the longest in the country, but wait times have

[27] https://www.pewtrusts.org/en/research-and-analysis/data-visualizations/2014/elections-performance-index#indicatorProfile-WTV

[28] https://medium.com/mit-election-lab/insights-into-voting-wait-time-from-the-2016-elections-performance-index-6693576e9b99

[29] Charles Stewart, III, "Managing Polling Place Resources," Report of the Caltech/MIT Voting Technology Project. December 2015, Appendix 1.

[30] Weil et al. 2019, *op cit.* Figure 1.

[31] Weil et al. 2019, *op cit.* Figure 1.

increased more dramatically in Georgia than in other states between the midterms of 2014 and 2018.

Another potentially useful source of cross-state data is the study that estimated wait times in the 2016 election using cell phone data.[32] Due to cross-state and cross-county differences in the sample size, and cross-county differences in the ability of researchers to accurately extract signal from noise in the pings from phones, one must be careful about making comparisons across states, Congressional districts, and especially counties. In this study, Georgia was one of a group of states with an average estimated 2016 wait time of around 20 minutes, and it was ranked fifteenth overall. The study also found a significant racial disparity in wait times not only in their full U.S. sample, but also within Georgia (Table A.8). In the authors' estimates for the 100 largest U.S. counties, Cobb, DeKalb, and Fulton were clustered around the Georgia average of around 20 minutes, but Gwinnett's estimated average 30-minute wait was ranked number four overall (behind Baltimore, St. Louis, and Salt Lake City; *see* Table A.10). Of course, this is an average across cell phone pings at polling places, some of which experienced no wait at all, and others of which waited far longer than 30 minutes.

[32] Chen et al. 2019, *op cit.*

VI. WHO EXPERIENCES LONG LINES IN GEORGIA?

In sum, Georgia is one of the U.S. states with a clear and persistent problem with long lines at polling places in recent decades. These problems have been documented in media reports and academic studies, which have also indicated that the problems are most prevalent in urban communities with large minority populations. The remainder of this report dives much deeper into the data from June of 2020, demonstrating that the findings of the broader literature about race and long lines can also be clearly discerned in Georgia: minority communities are indeed disproportionately impacted by long lines. Unfortunately, the type of data collected by the collaborators on the Bipartisan Policy Center/MIT study were not available for this primary. I know of no teams of researchers who systematically sampled polling locations in Georgia and tracked wait times throughout the day. Nor do I have access to systematic survey data in which voters from various polling locations were asked how long they waited in line.

However, I do have access to valuable data on the number of voters who checked in each hour in each polling place in Georgia on June 9, 2020. Alone, average check-ins per hour are not especially useful for assessing wait times without some information about how many voters may have been lining up to check in. One polling place might have an average check-in time of one minute per voter and have no lines at all, while another polling place could have a similar or even lower check-

in time and end up with huge lines because of a larger surge of voters and inadequate resources (pollbooks, machines, or workers) to keep up. For example, some of the Fulton County precincts featured in media reporting on long lines were actually quite efficient at checking in massive numbers of voters.[33] The Park Tavern polling place in Atlanta, for example, was able to achieve a relatively efficient check-in time of well under one minute per voter, but still experienced exceptionally long lines.

It is clear from media reports that at many polling places, long lines formed before the polling place opened in the morning, and the numbers were simply too great and the resources too few to catch up. Surely there are polling places that eventually caught up, but some did not, and at many polling places, hundreds of people were still in line when the polls were scheduled to close at 7 PM. These polling places were allowed to stay open as long as was necessary to process those already in line, but according to Georgia law, new individuals were not permitted to enter the line. According to O.C.G.A §821-2-413(g):

"when the hour for closing the polls shall arrive, all electors who have already qualified and are inside the enclosed space shall be permitted to vote; and in addition thereto, all electors who are then in the polling place outside the enclosed space, or then in line outside the polling place, waiting to vote, shall be permitted to do so if found qualified, but no other persons shall be permitted to vote."

[33] https://www.gpb.org/news/2020/07/17/heres-what-the-data-shows-about-polling-places-lines-in-georgias-primary

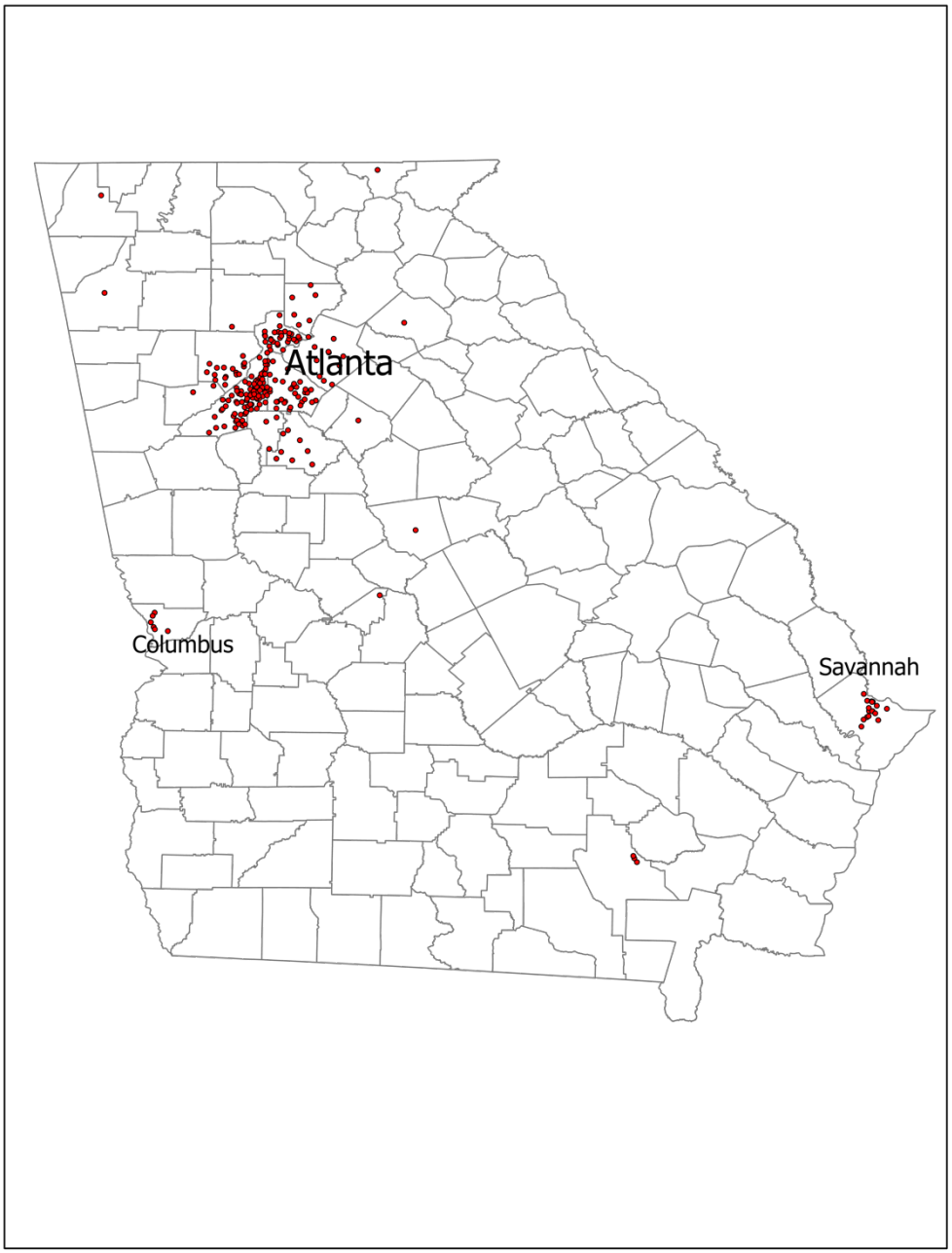
This provides us with an opportunity to identify troubled precincts. First, a simple binary way of identifying precincts experiencing long lines is to ask whether they were still processing voters after 8 PM (one hour after the official closing time). Figure 3 provides a map of all of the polling places that were still processing voters after 8 PM. We can see from Figure 3 that these polling places were concentrated in the Atlanta metro area, as well as in Savannah and Columbus.

Second, we can count up the total number of voters processed after the official closing time of 7 PM. In some cases, only a handful of voters were checked in a few minutes after 7 PM, while in other cases, hundreds of voters were processed over several additional hours.

Third, if we assume that election officials implemented the law and no additional voters were allowed to get in line after 7 PM, we can take the time that elapsed between 7 PM and the time of the last check-in as an estimate of the minimum wait time experienced by the *last* voter of the day. This is likely a severe under-estimate of wait times throughout the day. Previous studies have shown that wait times are typically longest in the morning, and gradually improve throughout the day.[34] Moreover, this is most likely an underestimate even of the wait time experienced by *late* voters, since it is entirely possible that the last voter in line was already waiting for a substantial amount of time before 7 PM.

[34] Weil et al. 2019, *op cit.*

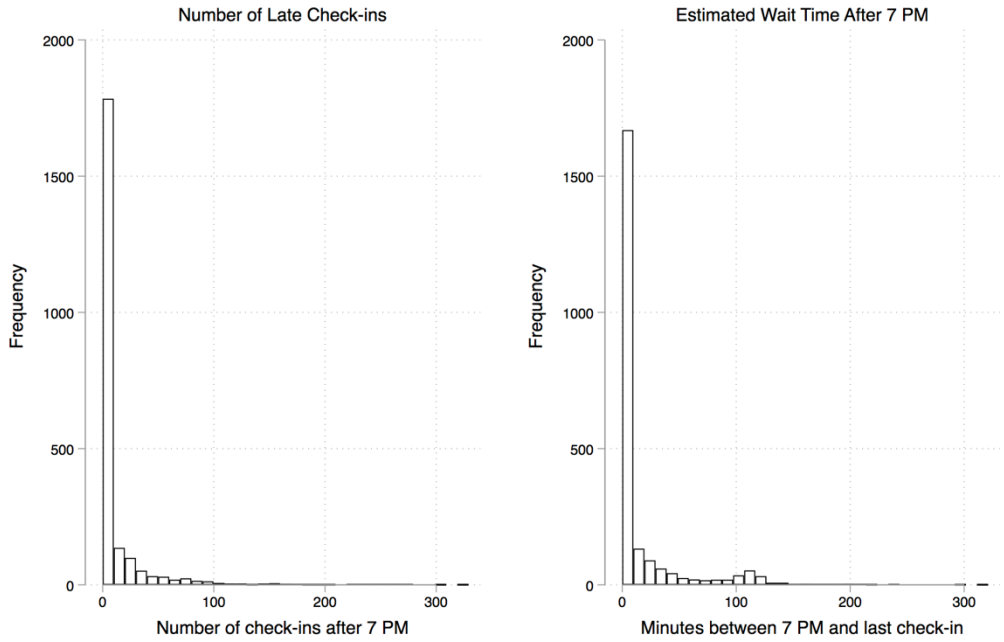
Figure 3: Polling Places Open After 8 PM



While we should view the estimates of wait times calculated in this way as an underestimate of actual average wait times during the day, this approach should allow us to draw solid inferences about *variation* across polling places. If polling

place *A* processed its last voter at 6:55 PM and polling place *B* processed 200 voters after 7 PM and finished its last voter at 10:30 PM, we can safely conclude that polling place *B* experienced substantially longer lines, at least in the latter part of the day, and in all likelihood, earlier in the day as well.

Figure 4: The Distribution of Late Check-ins and Wait Times after 7 PM, Georgia Polling Places, June 9,2020



As demonstrated in the map above, the class of polling-place bottlenecks that led to late check-ins were not evenly distributed across Georgia. Of 2,258 polling places in the data set, 238 (11 percent) checked voters in after 8 PM. Figure 4 provides histograms of the number of voters checked in after 7 PM (in the left panel) and the time that elapsed between 7 PM and the last check-in (in the right panel)

across Georgia polling places in June 9, 2020. These highly skewed distributions indicate that the problem of late check-ins was quite concentrated in certain precincts. The majority of polling places checked in zero voters after 7 PM. However, in the right tail of the distribution are a substantial number of polling places where voters at the end of the day clearly experienced very long wait times. There were 236 precincts where more than 30 voters checked in after 7 PM, and 152 where more than 50 voters did so. There were 356 precincts where the estimated evening wait time was over 30 minutes, 236 where it was over one hour, 57 where it was over two hours, and 16 where it was over 3 hours.

The precincts served by the polling places in the far-right tail of the distribution in Figure 4 are disproportionately composed of minority voters. Figures 3 and 4 provide maps of polling places that were open past 8 PM, again with red dots, along with data on African-Americans as a share of the population at the level of census block groups from the most recent American Community Survey. Figure 5 includes the entire state, and Figure 6 zooms in on the Atlanta area. One can see from the maps that many of the neighborhoods served by troubled polling places had African-American majorities. It is also clear that these problems were not common in rural African-American areas with declining populations, but rather, in urban and suburban African-American neighborhoods in Atlanta, Savannah, and Columbus.

Figure 5: Polling Places Open After 8 PM and African-American Share of Population, Georgia

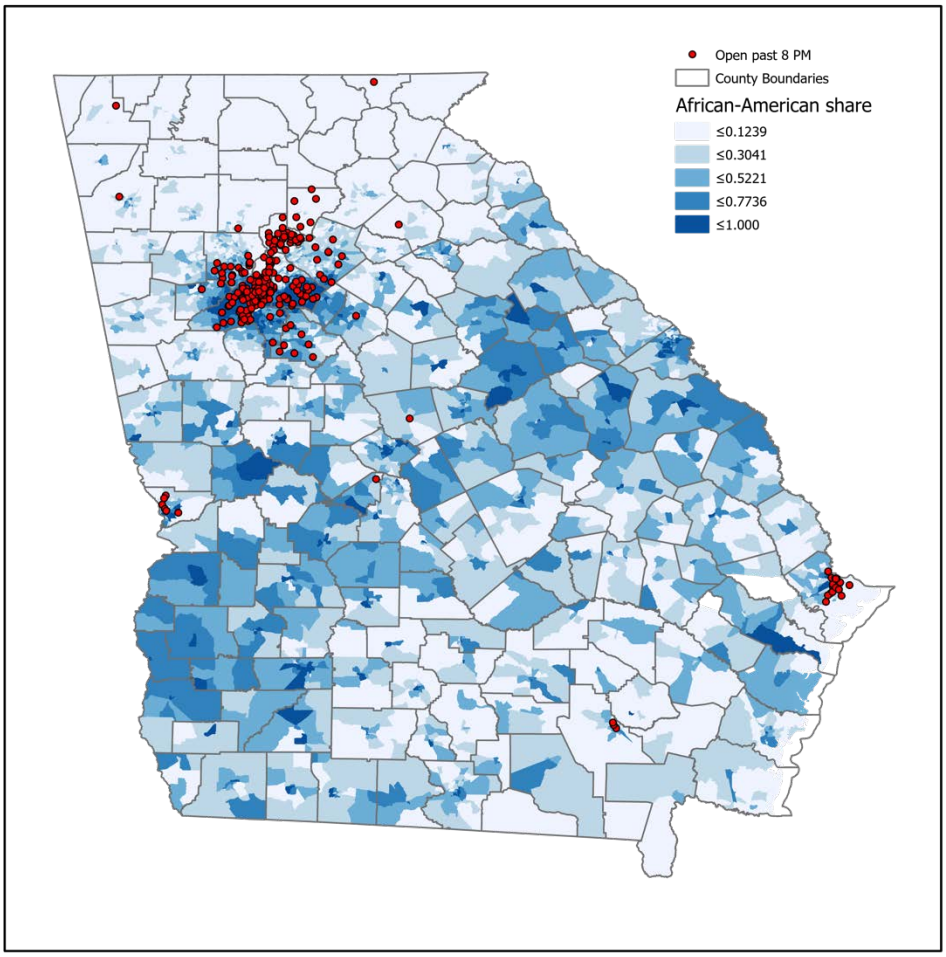
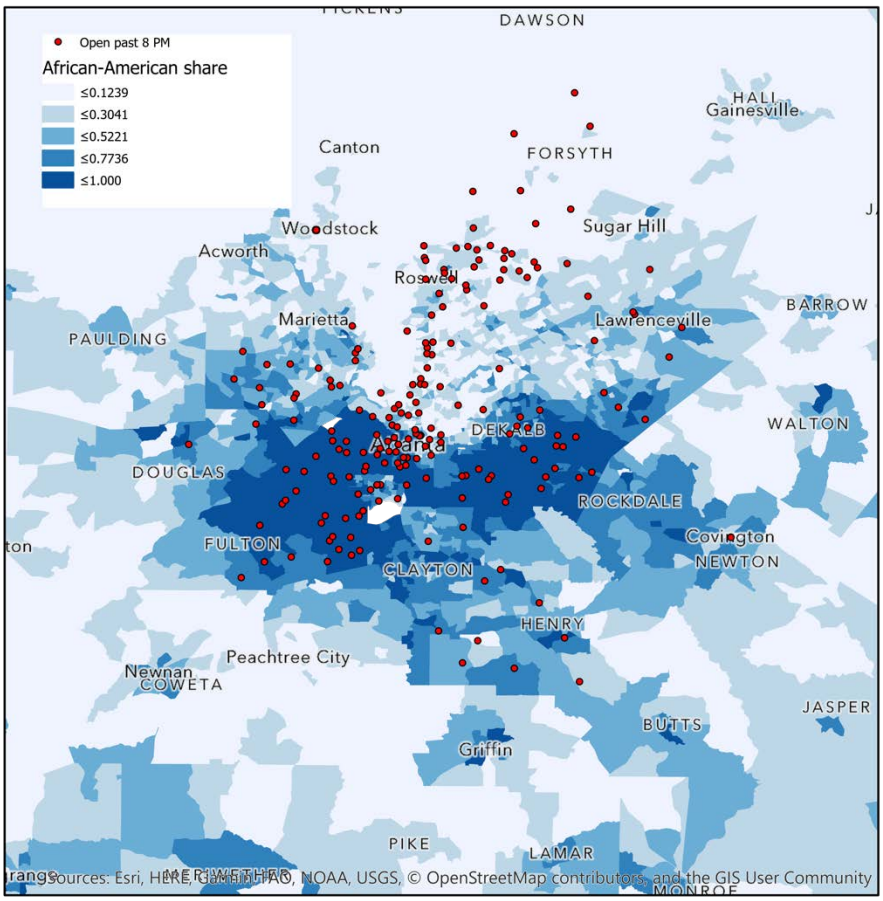


Figure 6: Polling Places Open After 8 PM and African-American Share of Population, Atlanta Area



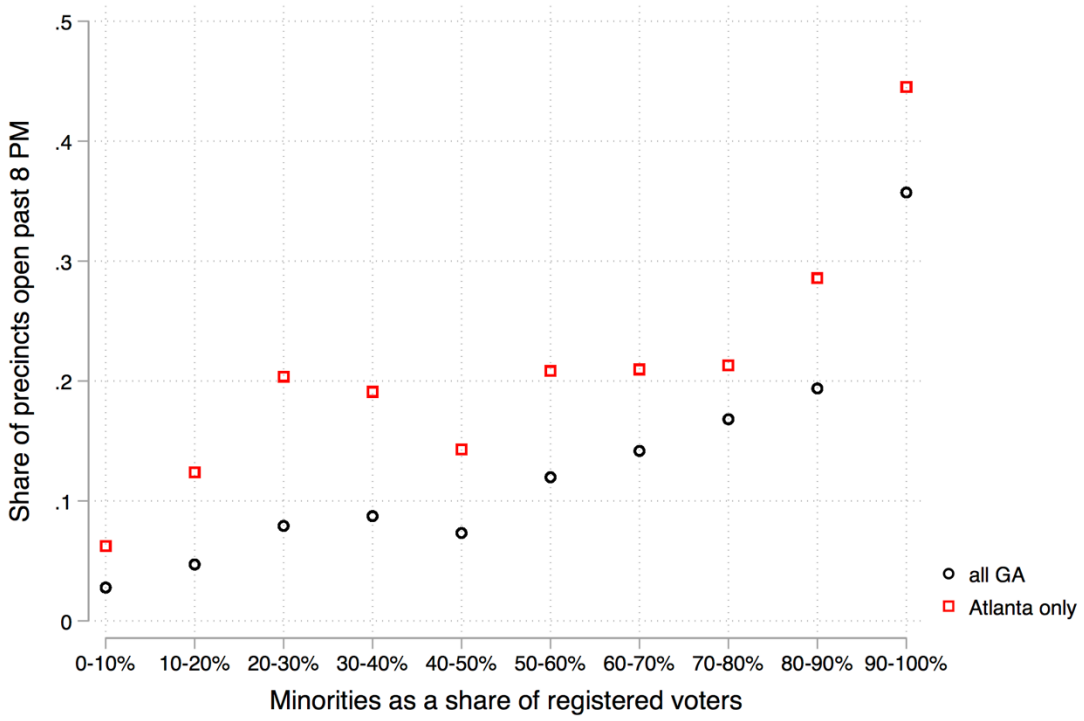
For each polling place, using data on self-reported race in the voter file, I calculate the share of voters that describe themselves as African-American, Hispanic, Native American, or Asian. These minority groups constituted local majorities in 32 percent of the polling places used in June 9, 2020 in Georgia. However, these majority-minority polling places accounted for over 63 percent of the polling places that were still processing voters after 8 PM.

Another way to look at the data is to calculate the share of majority-white polling places that were still processing voters after 8 PM versus the share of majority-minority polling places where this was true. Only 6 percent of majority-white precincts were forced to stay open past 8 PM, while 21 percent of majority-minority polling places had to do so. In other words, the rate at which polling places experienced problems requiring them to stay open late was well over three times higher for minority precincts. Breaking the data down a bit further, we can see that the rate at which polling places stayed open late is highly correlated with race and ethnicity, but the problem is especially severe in polling places where the population is overwhelmingly composed of minorities.

Figure 7 presents the share of polling places open past 8 PM for precincts where minorities make up 0 to 10 percent of registered voters, 10 to 20, and so on, up to the highest category—the polling places where minorities made up more than 90 percent of registered voters. Figure 7 demonstrates a linear increase in the share of polling places open past 8 PM as the minority share of registered voters increases, up to the group of precincts where minorities make up 80 to 90 percent of the population. However, after that, there is a discontinuous jump in the share of polling places open late. The share of polling places that were open past 8 PM in the 129 precincts where minorities made up 80 to 90 percent of registered voters was around 19 percent, but in the 196 precincts where minorities made up 90 to 100 percent of

registered voters, it jumped all the way to almost 36 percent. Note that at the opposite extreme—the 360 precincts where non-Hispanic whites made up over 90 percent of registered voters—the rate at which polling places were open late was less than 3 percent.

Figure 7: The Share of Polling Places Open Past 8 PM, by Minorities as a Share of Registered Voters, Georgia Polling Places, June 9,2020



The connection between race/ethnicity and problems with in-person voting on election day is not merely a reflection of the fact that minority-dominated precincts are concentrated in the Atlanta metro area. The red squares in Figure 7 limit the analysis exclusively to the Atlanta metro area.[35] The fact that all of the red squares

[35] I define the Atlanta metro area to contain the counties of Cherokee, Clayton, Cobb, Coweta, Dekalb, Douglas, Fayette, Fulton, Gwinnett, Henry, Paulding, and Rockdale.

are higher than the black circles indicates that the share of polling places that were open late was higher in the Atlanta metro area across the board than in the rest of the State regardless of precinct racial shares. However, we can also see that the relationship between the racial composition of the polling place and the likelihood of late check-ins holds up *within* the Atlanta metro area. Among the Atlanta-area polling places that were over 90 percent non-Hispanic white, around 6 percent were still checking in voters after 8 PM, while among the Atlanta-area precincts where the minority population was over 90 percent, around 45 percent were doing so.

Another way to examine the data is to avoid using data that is aggregated to the level of the polling place, and instead go directly into the voter file and examine the proportion of each (self-described) racial/ethnic group that lives in a precinct assigned to a polling place that was open past 8 PM. For non-Hispanic whites, 11 percent of registered voters were assigned to such polling places. For African Americans, the figure was over twice as high: 24 percent. For Hispanics, it was 16 percent, and for Asian Americans/Pacific Islanders it was 22 percent.

It is also useful to examine the relationship between race/ethnicity and the other two metrics discussed above: the total number of voters checked in after 7 PM, and the time that elapsed between 7 PM and the last check-in. This information is presented in Figures 8 and 9 below. Both figures demonstrate a strong relationship between race/ethnicity and difficulties at polling places in the June 2020 Primary.

Whether we look at Georgia as a whole or focus only on the Atlanta metro area, there is a strong polling-place-level relationship between the relative size of the minority population and the average number of voters who checked in after 7 PM, as well as the average evening wait time. In polling places where non-Hispanic whites made up over 90 percent of the population, on average, four voters were checked in after 7 PM, and the average evening wait time was around four minutes. In polling places where minorities made up over 90 percent of the population, around 30 voters checked in after 7 PM, and the average evening wait time was around 51 minutes.

Figure 8: Average Number of Voters Checked in After 7 PM, by Minorities as a Share of Registered Voters, GA Polling Places, June 9, 2020

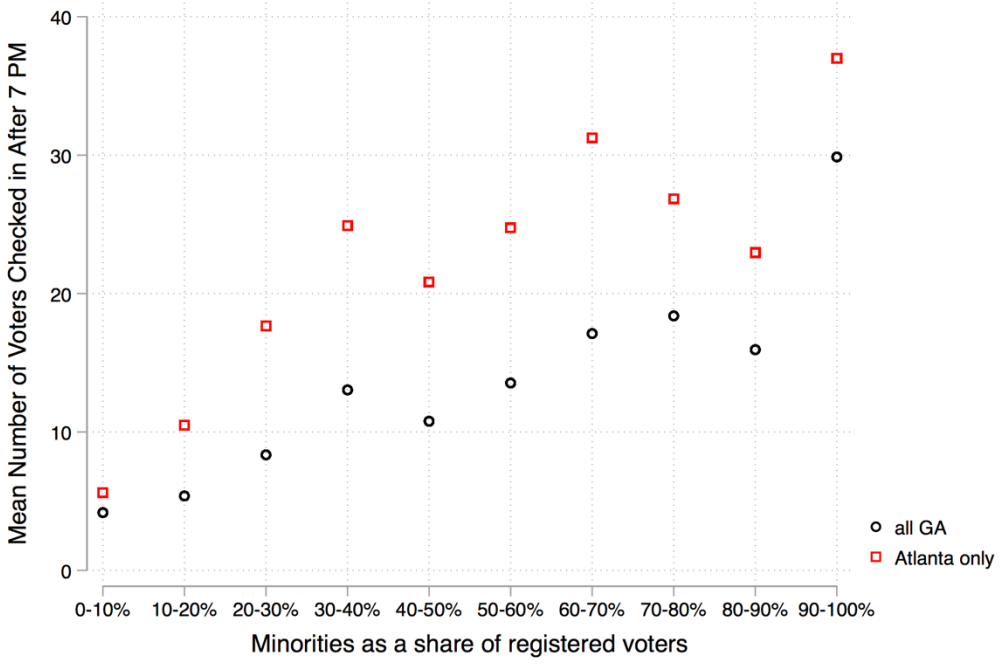
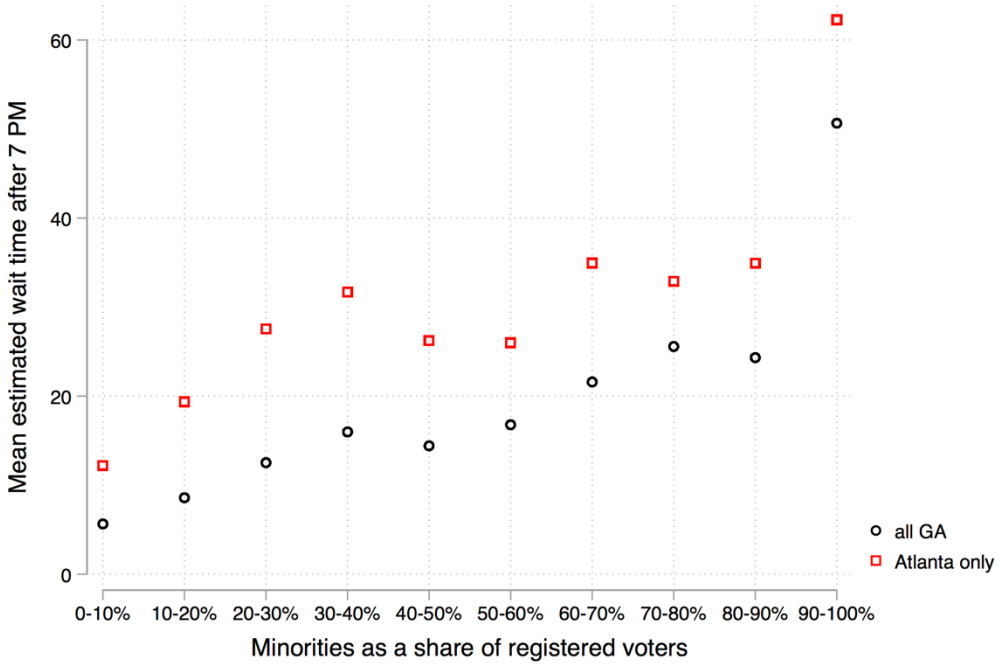


Figure 9: Average Minimum Wait Time After 7 PM, by Minorities as a Share of Registered Voters, GA Polling Places, June 9, 2020



It is also useful to look beyond the averages and take a closer look at the smaller group of polling places in the right tail of the distribution in Figure 4 above—where the number of voters checked in after 7 PM was much higher than average, and where estimated evening wait times were much higher than average. Around 63 percent of the polling places where more than 50 voters checked in after 7 PM were majority-minority precincts. Around 62 percent of the polling places with estimated evening wait times greater than 90 minutes were majority-minority polling places. As mentioned above, in only 32 percent of all polling places in Georgia did minorities constitute majorities. Around four percent of majority-white precincts checked in more than 50 voters after 7 PM, while around 13 percent of minority-majority precincts did so. Around four percent of majority-white precincts

experienced minimum evening wait times greater than 90 minutes, while 15 percent of minority-majority precincts did so. When whites constitute more than 90 percent of registered voters, the average minimum evening wait time is around six minutes. When minorities constitute more than 90 percent of registered voters, the average is 51 minutes. No matter which of these metrics is used, then, the prevalence of relatively serious polling place difficulties is more than 3 times greater in minority-majority precincts than majority-white precincts.

Finally, since race, urbanization, and partisanship are so highly correlated in Georgia, it is useful to examine the prevalence of polling place difficulties by party in addition to race. Included in the vote history file from the June 2020 election is a variable that indicates whether the individual voted in the Democratic or Republican primary. I can then use this to assess the prevalence of polling place difficulties by party. Among those who lived in neighborhoods assigned to polling places that were open past 8 PM in June of 2020, 75.4 percent voted in the Democratic Primary, while only 21.7 percent voted in the Republican Primary. Among those who lived in neighborhoods where the polling place was closed by 8 PM, 50 percent voted in the Republican Primary and 47.8 percent voted in the Democratic Primary. Or to look at the data another way, 22 percent of those voting in the Democratic Primary lived in a troubled precinct, while 7.2 percent of those voting in the Republican Primary

lived in these precincts. In other words, the rate was three times higher for Democrats than for Republicans.

VII. WHAT EXPLAINS THE LONG LINES?

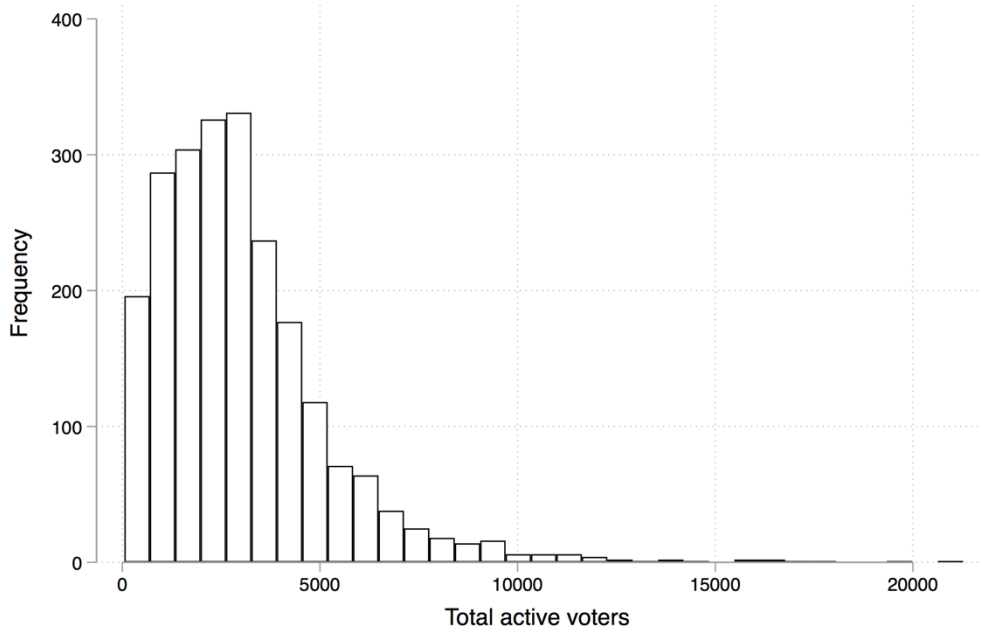
Why do some polling places experience longer lines than others? And what accounts for the racial disparities in long lines outlined above? This section considers several potential explanations. First, I consider the raw numbers of active voters assigned to each polling place, and find strong evidence that lines are longer when a polling place must process a larger number of voters, and that this problem is more severe in polling places that serve multiple precincts, especially in metro Atlanta. I also consider differences between absentee and Election-Day voting, and establish that the polling places with the largest problems in the June 2020 Primary appear to have been those where relatively large shares of voters showed up for in-person rather than early or absentee voting. Finally, I present evidence that there are racial disparities in the size and structure of polling places, as well as in the use of Election-day vis-à-vis early or absentee ballots, as well as in the use of provisional ballots.

The Number of Voters Assigned to Vote at Each Polling Place

Perhaps the most obvious explanation for long lines at polling places has to do with the number of voters attempting to vote at each polling place. As mentioned above, Georgia had among the longest average wait times in 2014, and had the

longest wait times in the country in 2018.[36] It is probably not a coincidence that relative to other states, Georgia also requires extremely large numbers of voters to cast their ballots at a single polling place. This is the case in normal elections, but the numbers of voters per polling place grew even larger in the June 2020 Primary—especially in urban areas that experienced additional consolidations due to COVID.

Figure 10: The Distribution of Active Voters Across Polling Places, Georgia June 9, 2020 Primary Election



According to the Election Assistance Commission, in 2016, 48 percent of jurisdictions in the United States had less than 1,000 registered voters per polling place, 27 percent had between 1,000 and 2,000, and only 25 percent of the

[36] Weil et al., 2019, *op cit.*, Figure 1, page 8.

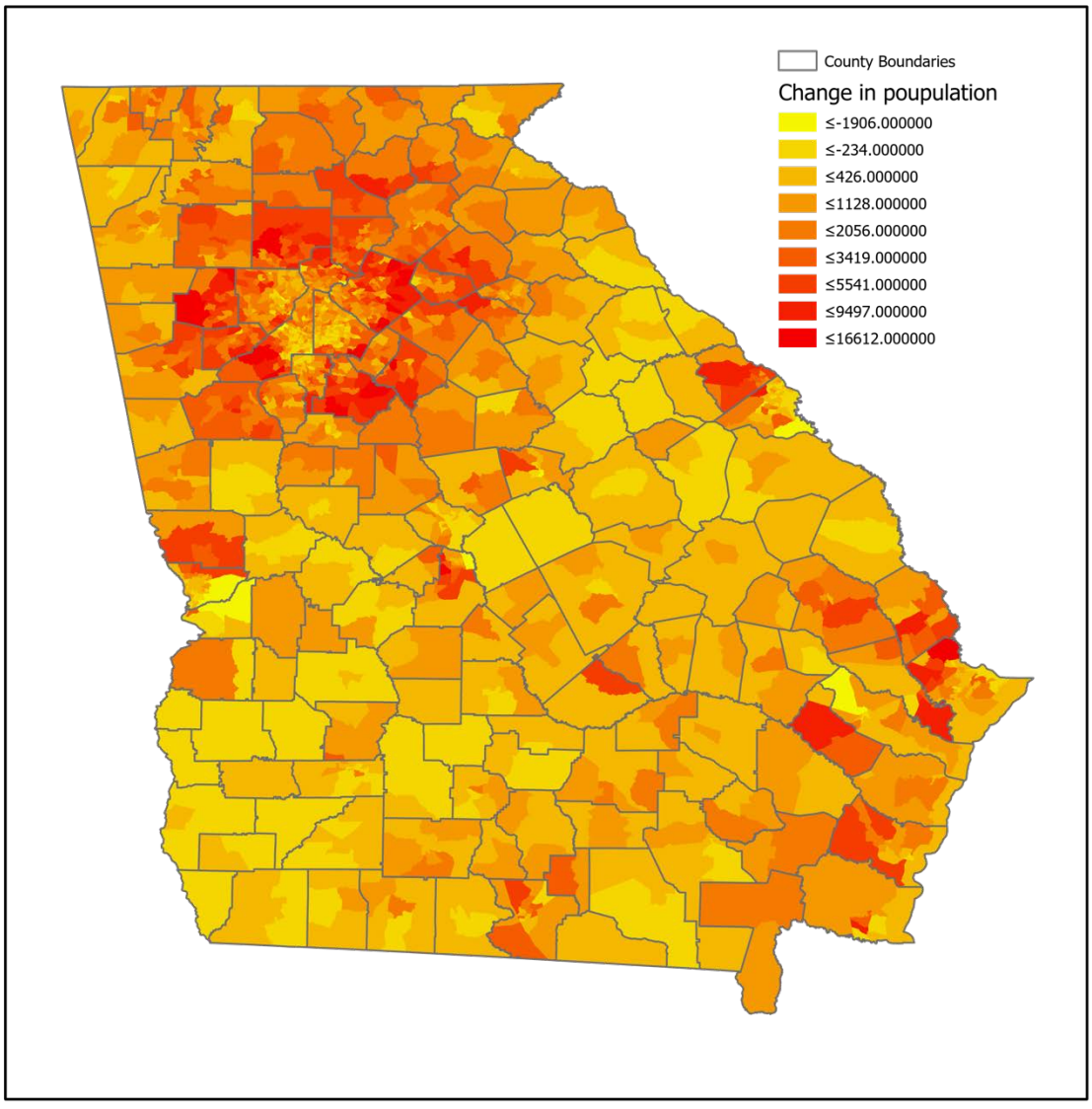
jurisdictions had more than 2,000 registered voters per polling place.[37] Figure 10 displays a histogram of the total number of active voters across all of the polling places used in the June 2020 Primary, making clear just how far Georgia deviates from practices elsewhere. In Georgia in June of 2020, only 15 percent of polling places served less than 1,000 active registered voters; 20 percent served between 1,000 and 2000; and 65 percent of polling places had more than 2,000 active registered voters. In fact, 42 percent of the polling places served over 3,000 people. But the right tail of the distribution is especially striking: There were 316 polling places serving over 5,000 people each, and 35 that served over 10,000. Polling places serving such massive numbers of voters are extremely unusual. According to the Election Assistance Commission, the overall average of registered voters per polling station in the United States was 1,547 in 2016. In Georgia in June of 2020 it was almost twice as large: 3,046. This issue was addressed in a recent study by the Brennan Center, which concluded that the average polling place in Georgia had 530 in-person Election Day ballots cast in 2014, but that number grew to 770 in 2018—an increase of almost 50 percent.[38]

[37] Election Assistance Commission: *EAVS Deep Dive: Poll Workers and Polling Places*, p. 4. Note that the EAC sample excludes three states that automatically mail ballots to all voters: Colorado, Washington, and Oregon.

[38] Hannah Klain, Kevin Morris, Max Feldman, and Rebecca Ayala, "Waiting to Vote: Racial Disparities in Election Day Experiences," Report of the Brennan Center for Justice, New York University School of Law, June 3, 2020, page 12.

Georgia is experiencing strong population growth, gaining almost one million additional residents since 2010. The Atlanta metro area is one of the four fastest-growing metros in the United States. Figure 11 provides a map of population growth in Georgia from 2010 to 2018.

Figure 11: Map of Population Growth in Georgia



Yet unlike other growing areas in the United States, the Atlanta metro counties, and the State as a whole, have not been adding new polling locations to keep up with population growth and the increased turnout in recent elections. Rather, the number of polling places has been decreasing.

According to a branch of managerial science known as queuing theory, "long lines are fundamentally due to a mismatch between the number of voters who show up and the resources available to accommodate them."[39] Ideally, each polling place will have sufficient resources to deal with the anticipated arrival rate—the number of voters who show up each hour. For small increases in the arrival rate, the wait time should increase only slightly. However, given the number of pollbooks, workers, and voting machines, there is a "utilization limit"—an arrival rate beyond which the wait time increases exponentially as the arrival rate increases.

Although it is undoubtedly the case that individual polling places experienced a host of specific problems leading to delayed opening in the morning or slowdowns during the day, it is likely that many of the polling places with long lines reached their utilization limit due to large numbers of voters and insufficient resources. The arrival rate was simply too high given the resources at hand. Consistent with the broader literature on polling place utilization limits,[40] the difficulties on June 9, 2020

[39] Stewart, 2015, *op cit.*, p. 1.
[40] Stewart, 2015, *op cit.*, Weil et al. 2019, *op cit.*

were concentrated in many of the largest urban precincts. Of the 242 precincts that were still checking in voters at 8 PM, 227 (94 percent) had numbers of active registered voters above the national average of 1,547, and 203 (84 percent) were above the Georgia median of 2,646 active registered voters. The vast majority of these troubled polling places were in the Atlanta metro area (83 percent).

Figure 12: Late Check-ins and Wait Times Against Number of Active Registered Voters, Polling Places, GA June 9, 2020 Primary Election

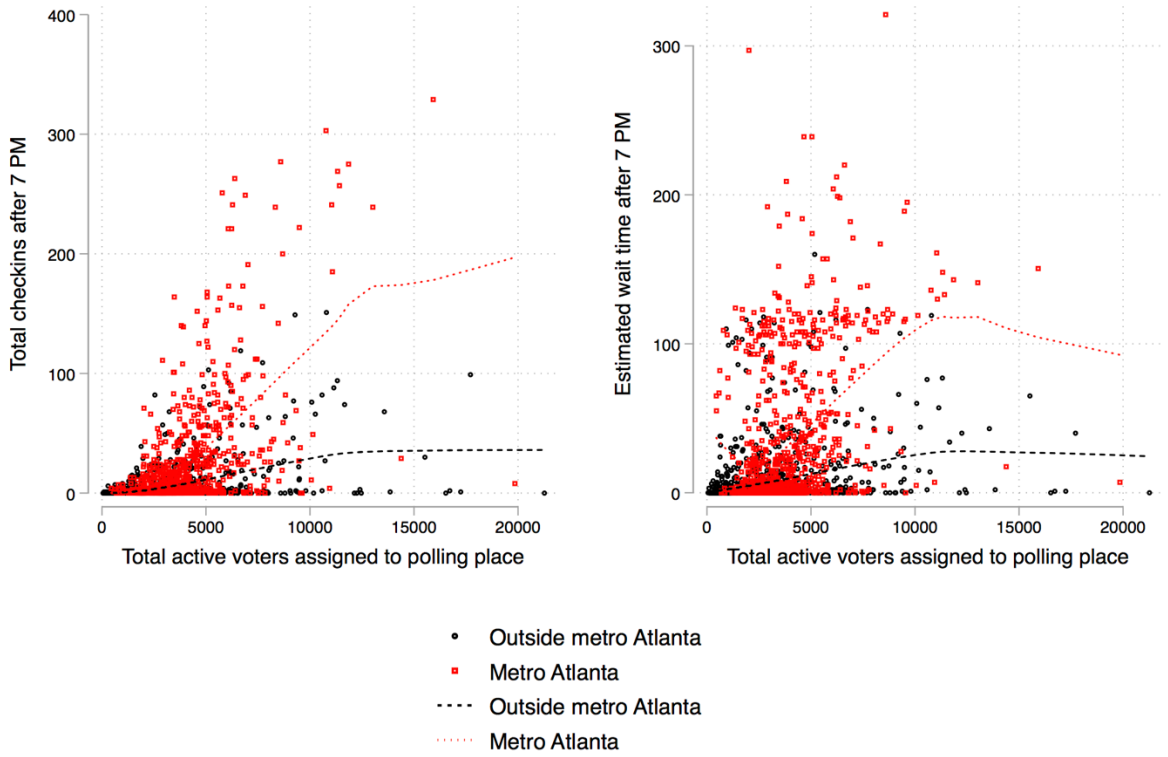
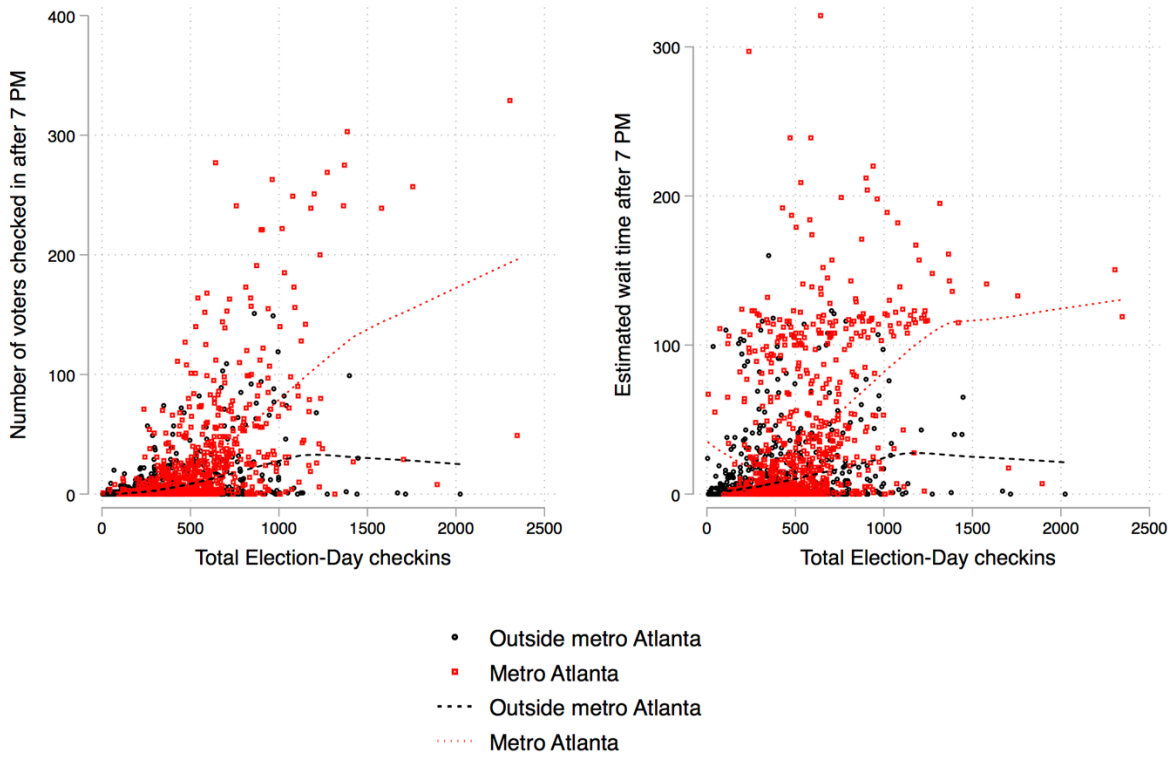


Figure 12 plots total late check-ins (in the left-hand panel) and evening wait times (in the right-hand panel) against the total number of active voters assigned to the polling place. It differentiates between metro Atlanta polling places, in red, and the rest of the state, in black. It also portrays with dashed lines the relationship between

the two variables—again broken down by the Atlanta/non-Atlanta divide—as captured by a locally-weighted regression. It is clear that wait times increase as the number of active registered voters assigned to a polling place increases, and that this relationship is especially strong in the Atlanta metro area. Across all polling places in the State, the average evening wait time was around four minutes for all of the precincts at or below the national average size of 1,547. For those above the statewide median, it was around 27 minutes. For those with more than 5,000 active voters, it was around 50 minutes.

Figure 13: Late Check-ins and Wait Times Against Number of Election-Day Check-ins, Polling Places, GA June 9, 2020 Primary Election



It is perhaps more useful to look at the number of people who actually showed up on Election Day rather than those who were registered. Figure 13 explores this and demonstrates that there is a strong relationship between the number of in-person voters and both late check-ins and estimated minimum evening wait times, driven primarily by the Atlanta metro area.

Many of the troubled Atlanta-area polling places that serve massive numbers of voters have something in common: they simultaneously serve several precincts. At the polling location, this typically involves completely different check-in lines for different precincts. Upon arrival, voters must find the line that corresponds to their precinct. When the lines stretch outside, around the corner, or even down the block, this can be a difficult task. Voters sometimes see a long line and queue up, only to discover much later that they have been in the wrong line all along. This can be a problem even in an election without the challenges of COVID-19. In June of 2020, especially in Fulton County, some polling places that *already* were slated to serve multiple precincts were consolidated further. For instance, in Fulton County, a clump of two precincts was combined with another clump of three precincts, and on June 9, 2020, voters from all five precincts were all assigned to the polling place at Clark Tavern, with an active voter count of almost 16,000, of whom around 2,300 showed up on Election Day, evidently surpassing the polling place's utilization limit.

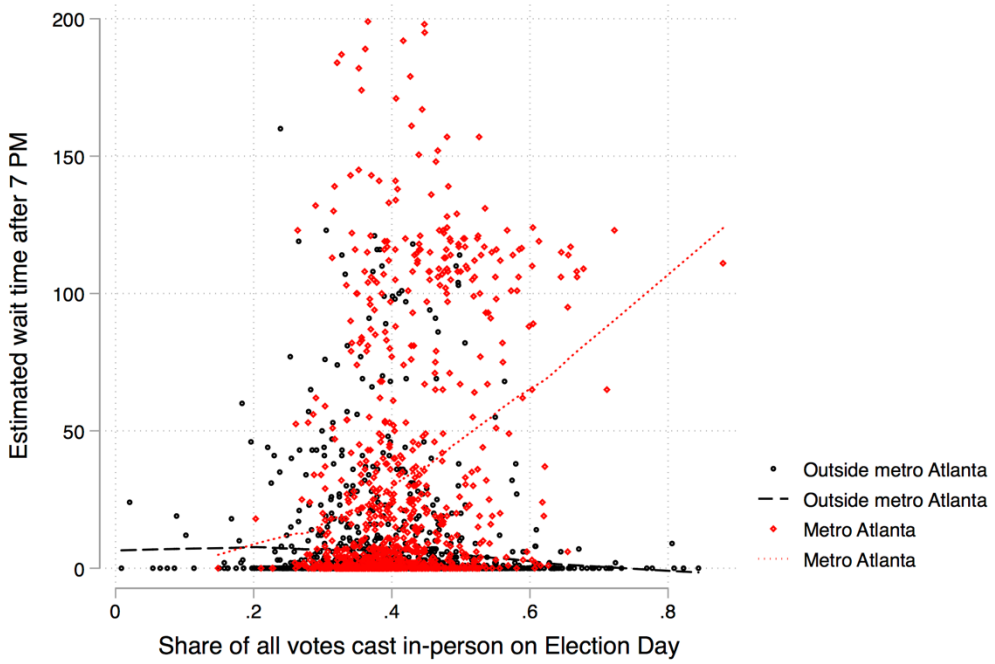
I have attempted to characterize each polling place used in the June 2020 Primary according to whether it serves a single precinct or multiple precincts. I found 185 polling places that served multiple precincts, 134 of which were in metro Atlanta, and 102 of which were in Fulton County alone. These polling locations clearly accounted for a large part of the problem in the June 2020 Primary. Only 7 percent of the polling places that served a single precinct checked in voters after 8 PM, whereas of those serving multiple precincts, 52 percent did so. The average number of check-ins after 7 PM was 8 in the polling places that served a single precinct, and 49 in those that served multiple precincts. The average minimum wait time after 7 PM was around 12 minutes in single-precinct polling places, but it was *one hour and nine minutes* in the polling places that served multiple precincts.

Due to the COVID-19 pandemic, Georgia has taken steps to make absentee voting easier, and an unusually large number of Georgia voters chose to cast absentee ballots for the June 2020 Primary Election. In theory this should have eased the burdens faced at polling places, and most likely, wait times on June 9 would have been considerably worse without the expanded use of absentee and early voting. However, the take-up of early and absentee voting, and hence the easing of the burden on polling places, was quite heterogeneous from one polling place to another. For instance, in the Atlanta area, the range was from Evergreen Church in Fayette County, where only around 15 percent of all votes cast in the election were done in-

person in Election Day, to Samuel H. Archer Hall at Morehouse College in Fulton County, where 88 percent of the total votes were case in-person on Election Day.

It appears that wait times may have been slightly higher at polling places where larger shares of voters chose the option of in-person Election-Day voting. The share of votes cast in-person on Election Day was 39.8 percent in the precincts that did not check in voters after 8 PM, but 44.4 percent in the precincts that did. There is no discernable relationship between the share of votes cast on election day and the number of voters checked in after 8 PM, but Figure 14 below suggests a positive correlation between the share of all votes cast in-person on Election Day and the estimated evening wait time, driven largely by Atlanta-area polling places.

Figure 14: Wait Times Against Share of Votes Cast In-Person on Election Day, Polling Places, GA June 9, 2020 Primary Election



Using all of the data to estimate a simple bivariate regression of the estimated wait time on the share of all votes cast in-person on Election Day, I obtain a coefficient that is highly statistically significant, and indicates that going from almost all absentee and early voting to almost all in-person Election-Day voting is associated with an increased evening wait time of around 45 minutes.

This highlights a subtle but deep-rooted problem with election administration in Georgia. Partially because of the anger over long lines in 2000, described above, Governor Perdue signed into law a bill in 2003 that would allow early voting in Georgia for the first time. When advocating for the new legislation, a spokesperson for the Secretary of State argued that it would not only "reduce the Election Day turnout," but would also enable growing countries to "avoid" or "postpone buying more electronic voting machines."[41] This prediction was wrong. As Georgia has grown, and as elections have grown more competitive and turnout has increased, the rise of early and now mail-in voting have not obviated the need for additional investments in Election-Day voting resources. Numbers of Election-Day voters are only growing while the number of polling places continues to shrink. Meanwhile, time and again, when speaking to the news media after an election marred by long lines, election administrators point to high levels of early voting as part of the reason

[41] "Georgia: No Excuses? No More!" *Atlanta Journal-Constitution* June 10, 2003.

for their surprise at the level of Election-Day turnout. But given the frequency of this experience since 2000, this should no longer be surprising.

Racial Disparities

To summarize, at the level of polling places, estimates of wait times on June 9, 2020 are correlated with the raw number of people assigned to the polling place, the number of people who showed up to vote on Election Day, the share of all votes that were cast in person on Election Day, and the practice of consolidating several precincts into one polling place. Next, I demonstrate that each of these factors is correlated with the racial/ethnic composition of the voters assigned to the polling place.

Table 1 below summarizes the results of three simple bivariate regressions. In each case, the independent, or explanatory variable, is the share of registered voters assigned to the polling place that are minorities. In the first column, the dependent, or outcome, variable is the total number of voters assigned to the polling place. In the second column, the dependent variable is the total number of in-person check-ins on June 9, 2020. And in the third column, the dependent variable is the share of all votes registered in the precincts assigned to the polling place that were cast on Election Day.

In each case, the relationship is statistically significant (the *p*-values are all less than .001). The coefficients indicate that going from an all-white to an all-

minority polling place is associated with an additional 882 total active voters assigned to the polling place, 85 additional voters on Election Day, and an increase of three percentage points in the share of voters casting their ballot on Election Day.

Table 1: Bivariate Regressions Assessing the Relationship Between Race/Ethnicity and Polling Place Size and Election-Day Voting

	Dependent Variable:		
	Total Active Voters	Total Check-ins	Election Day Votes as Share of Total
Minority share of registered voters	881.75 ***	85.46 ***	0.03 ***
	(161.69)	(18.80)	(0.01)

Each regression has 2,257 observations
*** $p < .001$

In fact, it is possible to explore the question of race and Election-Day versus early and absentee voting with much greater precision using individual-level data rather than polling-place aggregates. I have merged the absentee file from the June 2020 Primary with the overall voter file, and can use self-described race in the voter file to get rather precise estimates of voting behavior by members of each racial group. According to this analysis, 36 percent of registered self-described African Americans cast a ballot, as did 20 percent of Asians, 18 percent of Hispanics, and 38 percent of whites. Table Two explores the type of ballot cast by each group (conditional on voting).

Table 2: Types of Ballots Used by Racial/Ethnic Groups, Conditional on Voting, June 19, 2020

	In-Person Election Day	In-Person Early	Absentee Mail-in	Provisional
African American	0.40	0.16	0.45	0.004
Asian	0.39	0.08	0.53	0.003
Hispanic	0.52	0.4	0.40	0.003
Non-Hispanic White	0.33	0.13	0.56	0.001

Table Two indicates that African Americans, Asians, and Hispanics are far more likely than whites to vote in-person on Election Day. Whites are far more likely than African Americans or Hispanics to make use of absentee mail-in ballots. Thus, election administrators should prepare for larger surges of in-person voting at polling locations with relatively large minority populations.

Table Two also explores provisional ballots cast by each group. Provisional ballots are a source of slowdowns for election administrators, since they require extra time and paperwork. Asians and Hispanics are three times more likely than whites to cast provisional ballots, and African Americans are four times more likely than whites to do so. This racial disparity also shows up in precinct-level aggregates. Thus, election administrators should be prepared to handle the need for provisional

ballots at polling places with relatively large numbers of minorities, and allocate resources that would help avoid slowdowns.

Finally, it is clearly the case that minorities are more likely than whites to live in polling places that serve multiple precincts. While minority groups constitute majorities in 32 percent of Georgia's June 2020 polling places, they constitute majorities in 44 percent of the polling places serving multiple precincts. Or to look at the data another way, 7 percent of majority-white polling places serve multiple precincts, while 11 percent of majority-minority polling places do so. For polling places where minorities make up 75 percent of the population or more, 15 percent serve multiple precincts, and for polling places where minorities are 90 percent or more of registered voters, the share serving multiple precincts goes up to 23 percent. If we focus on metro Atlanta, it is 27 percent, and in Fulton County, 58 percent.

In sum, minorities are more likely to live in the types of polling places that exhibit the features that were associated with longer wait times in the June 2020 Primary.

VIII. TURNOUT

Long lines are most likely to emerge in hotly contested elections with high turnout. Part of the reason for the emergence of long lines on Election Day in Georgia and beyond is a growing interest in electoral participation among many voters in an era of heightened polarization. Even with the rise of early and absentee

voting, the number of people attempting to vote in person, especially in urban areas with large minority populations, has been growing, but Election-Day administrative capacity in Georgia has not kept up. Thus, even though turnout might be growing overall, and growing for minority populations relative to the less competitive elections of the past, long lines can still have a negative impact on turnout relative to what it would be in the absence of this additional cost, and long lines can lead to lower turnout for the communities that must face those costs relative to unaffected communities.

In the review of academic and public policy literature above, one of the key findings in studies of long lines is that they undermine not only confidence in elections, but also turnout. Individuals who might face disciplinary action at work for an unexcused absence cannot afford to wait for over an hour in line, and might simply leave the polling place upon seeing the lines. Given the threat of COVID-19, some voters will be wary about waiting in long lines where social distancing might be difficult—especially in minority communities where the pandemic has been most prevalent. Research also suggests that voters who have experienced long lines are also less likely to vote in future elections. A final question about the June 2020 Georgia Primary is whether individuals assigned to precincts that experienced long lines were less likely to vote. Let us address this question first with aggregate data

at the level of polling places, and then with individual-level data taken directly from the voter file.

Table 3: Regression of Turnout on 1) Whether a Polling Place was Open Late and 2) The Average Estimated Evening Wait Time, GA Polling Places, June 9, 2020 Primary

	Model 1	Model 2
Minorities as share of registered voters	-0.10 ***	-0.10 ***
	(0.01)	(0.01)
Open after 8 PM	-0.02 ***	
	(0.01)	
Wait time after 7 PM		-0.0002 ***
		(0.0001)
Observations: 2,257 polling places		
*** $p < .001$		

Table 3 presents the results of regressions where the overall turnout of the polling place, defined as votes cast as a share of active registered voters, is the dependent variable. The key independent variable in the first model is simply an indicator variable that is zero if the polling place was not checking in voters after 8 PM, and 1 if it was doing so. Since turnout is often lower among minorities, in Georgia and indeed throughout the United States, even without long lines at polling places, I also include a control variable: minorities as a share of active registered voters. The coefficient from this model, displayed in the first column of Table 3, indicates that controlling for race, turnout was lower by around two percentage points in the precincts that were sufficiently troubled by long lines that they were still checking

voters in after 8 PM. In the second model, the key independent variable is the average evening wait time, in minutes. The raw coefficient is a bit difficult to interpret directly, but we can comprehend the substantive effect by calculating predicted values from the model. This model indicates that when the wait was less than five minutes, turnout was around 37 percent. But when the wait was over 50 minutes, it was 32 percent—a rather striking decrease of five percentage points.

It is clear that overall turnout was lower among voters assigned to the polling places that experienced long lines on June 9, 2020. However, one might question whether these regressions demonstrate that the long lines actually *caused* lower turnout. After all, long lines were not randomly distributed throughout Georgia. As established above, they were found primarily in urban precincts with large minority populations that had to process large numbers of voters. Ideally, in order to obtain a credible estimate of the causal effect of long lines, one would randomly assign long lines to some polling places and not others throughout the state, such that one would not need to worry about the possible confounding effects of things like population density and race, or other factors like gender or age that are known to affect turnout but that might not be uniformly distributed across polling places.

Since long lines are not distributed across polling places in this way, a second-best option is to use individual-level data from the voter file and attempt to control for as many of these potential confounders as possible. I have matched the precinct

codes in the polling-place-level data set with those in the voter file, and created an indicator variable for every registered voter, taking the value 1 if the individual lived in a precinct that was checking in voters after 8 PM on June 9, 2020, and 0 otherwise. The dependent variable is a simple indicator variable from the vote history file that takes the value 1 if the individual voted in the June 2020 Primary, and 0 otherwise.[42] From the voter file, I am also able to construct a number of individual-level control variables. First, I generate indicator variables for the individual's self-described race. The categories included in the regression are white, African-American, Asian/Pacific Islander, Hispanic, and Native American. The reference category is those whose race was either "other" or "unknown," so that the effects reported below can be interpreted as the extent to which that group's turnout was either higher or lower than that of this reference category. From the voter file, I can also ascertain the voter's age and gender, whether they lived in the Atlanta metro area, and I can calculate the natural log of the population density of the voter's census block group.

[42] A complication, of course, is that many individuals voted early. As mentioned above, white voters, who live disproportionately in precincts *not* afflicted by long lines, were much more likely to vote early, and thus were not eligible to vote on Election Day. It might seem sensible to drop early voters and focus only on turnout among voters who had not yet voted on Election Day. However, this would generate a biased sample. Let us make the reasonable assumption that some voters are more enthusiastic about voting than others. Let us assume that in one precinct, everyone has a preference to vote by mail, while in another precinct of equal size, everyone has a preference to vote in person. Let us assume that the distribution of enthusiasm is the same in both groups. The most enthusiastic individuals will have voted by mail in first group, leaving a less-enthusiastic group of voters that is still eligible to vote on Election Day. In the second precinct, the most enthusiastic voters will have waited for Election Day. Thus the turnout among voters still eligible to vote on election day will be higher in the second precinct, for reasons that have nothing to do with lines at the polling place.

I can also examine the individual's partisanship. Since Democratic partisanship is extremely highly correlated with African-American identity, and Republican partisanship is very highly correlated with a white self-description, I include only an indicator variable that takes the value 1 if the individual is an independent, and 0 if the individual consistently chooses the ballot of one party or the other in primaries. I anticipate a negative coefficient for this variable, since consistent partisan primary voters should be more likely to vote in the June 2020 Primary.

Table 4: Estimated Marginal Effects from Probit Models of June 2020 Turnout, All Active Registered Voters in Georgia

	Model 1			Model 2		
	Marginal Effect		Lower CI	Upper CI	Marginal Effect		Lower CI	Upper CI
Open after 8	-0.031	***	-0.039	-0.022	-0.013	**	-0.021	-0.004
African American					0.003		-0.001	0.008
White					0.092	***	0.087	0.096
Hispanic					0.039	***	0.034	0.044
Asian/Pacific Islander					0.043	***	0.036	0.049
Native American					0.034	***	0.023	0.046
Female					0.051	***	0.048	0.053
Age					0.006	***	0.006	0.006
Atlanta					0.034	***	0.028	0.039
Log population density					-0.013	***	-0.015	-0.011
Independent					-0.263	***	-0.267	-0.260
Observations:	6,827,795				6,819,856			

*** $p < .001$
** $p < .01$
Stndard errors clustered by precinct

In the first column of Table 4, using a probit model[43] without any of the control variables, I present the estimated marginal effect on turnout of a switch from

[43] A probit model is a type of regression model in which the dependent variable can only take two values. Here, the two values are "voted" and "did not vote." The purpose of a probit model is to estimate the probability that an observation with certain characteristics (e.g. race or age) falls into one of these two categories.

living in a precinct that was not open past 8 PM to living in one that was. The effect size in this individual-level model is a bit larger than the aggregate polling-place analysis presented in Table 3 above: a decline in turnout of around three percentage points.

In the second column, I include all of the control variables described above.[44] In this model that controls for race, age, gender, metropolitan status, population density, and partisanship, the effect size gets substantially smaller—living in a troubled precinct is associated with a decline in turnout of around 1.3 percentage points—but is still highly statistically significant. Since so many of the troubled polling places were located in metro Atlanta, it is also useful to break down the analysis by region. The first column in Table 5 presents marginal effects from the simple model for Atlanta only, and the second column includes all of the control variables in a model that includes Atlanta only. Table 6 does the same for all of the counties outside the Atlanta metro area.

[44] The model identifies some interesting demographic correlates of turnout in the June 2020 Primary. Turnout of whites was higher than that of other groups. Female turnout was substantially higher than male turnout, and turnout was higher among older voters. Controlling for race and density, turnout was higher in metro Atlanta. Other things equal, turnout was also lower in denser neighborhoods. And as anticipated, those without a history of choosing a partisan ballot in past primaries were much less likely to vote in the June 2020 Primary.

Table 5: Estimated Marginal Effects from Probit Models of June 2020 Turnout, Metro Atlanta Only

	Model 1			Model 2		
	Marginal Effect		Lower CI	Upper CI	Marginal Effect		Lower CI	Upper CI
Open after 8	-0.030	***	-0.04	-0.019	-0.020	***	-0.030	-0.011
African American					0.009	**	0.003	0.015
White					0.076	***	0.070	0.081
Hispanic					0.028	***	0.023	0.034
Asian/Pacific Islander					0.024	***	0.017	0.031
Native American					0.010		-0.004	0.025
Female					0.067	***	0.065	0.070
Age					0.005	***	0.005	0.005
Log population density					-0.009	***	-0.013	-0.005
Independent					-0.236	***	-0.240	-0.233
Observations:	3,302,845				3,300,047			

*** $p < .001$
** $p < .01$
Stndard errors clustered by precinct

Table 6: Estimated Marginal Effects from Probit Models of June 2020 Turnout, Non-Metro Atlanta Only

	Model 1			Model 2		
	Marginal Effect		Lower CI	Upper CI	Marginal Effect		Lower CI	Upper CI
Open after 8	-0.027	**	-0.045	-0.008	0.001		-0.012	0.013
African American					-0.001		-0.008	0.0066
White					0.107	***	0.1004	0.1128
Hispanic					0.034	***	0.027	0.0412
Asian/Pacific Islander					0.050	***	0.0405	0.0599
Native American					0.059	***	0.0419	0.0758
Female					0.034	***	0.0325	0.0363
Age					0.006	***	0.0063	0.0065
Log population density					-0.013	***	-0.015	-0.0119
Independent					-0.284	***	-0.288	-0.2799
Observations:	3,524,950				3,519,809			

*** $p < .001$
** $p < .01$
Stndard errors clustered by precinct

In the simple models without control variables, the estimated effect is still around three percentage points whether one examines metro Atlanta alone, or focuses only

on the rest of the state. However, in the model with control variables, the estimated effect is around two percentage points, and still highly statistically significant, in the analysis of the Atlanta area counties, whereas the effect disappears altogether in the full model outside of Atlanta. In short, when controlling for other demographic and geographic features, the effect on turnout of living in a precinct with long lines appears to be strongest in the Atlanta metro area.

One might worry about an additional confounder that is not considered in these regressions. It is possible that the urban, majority-minority precincts that were more likely to experience difficulties in June 2020 were also places where turnout is typically lower, especially in a primary, either because voters are less interested in elections, or because they are more likely to face higher costs of voting that are unrelated to long lines on Election Day. I have attempted to account for such factors by including control variables for race, population density, etc., but it is possible that there are still some lurking, unmeasured features of these neighborhoods that are associated with lower turnout.

To further account for these factors, one strategy is to consider *past* turnout. I can introduce a control variable that indicates whether the individual participated in the most recent elections of the same type: the 2016 Presidential Preference Election and the 2016 Primary. This approach has a downside, however. From my research into past reports in the Atlanta Journal-Constitution, it is clear that many of the same

urban precincts have faced long lines again and again. If the geography of long lines in June 2020 was similar to the geography of long lines in the past, I will be introducing what is known as "post treatment bias" into the regression. In other words, I would be controlling for what is actually a consequence of the "treatment" (long lines on Election Day). If long lines in the past also led to lower turnout in the past or present, by controlling for past turnout, I would be introducing bias into my analysis, and potentially undermining my ability to detect an impact of long lines in June 2020. Yet as can be seen in the analysis of Atlanta Journal-Constitution stories above, 2016 was a year with relatively little reporting on long lines. It is, thus, at least plausible that long lines in the 2016 Primary do not completely undermine this empirical strategy.

First, I run the same regressions as above, but include two control variables: an indicator that takes the value zero if the individual did not vote in the 2016 Presidential Preference Election, and 1 if the person did vote. The other control variable captures whether the individual voted in the 2016 Primary. In this way, we can control for whether the individual has demonstrated a past interest or proclivity to vote in primaries and presidential preference elections. The results are reported in the Appendix. They are almost identical to the results reported in the tables above. In the regression that includes the entire state, the negative impact on turnout associated with being assigned to a troubled precinct goes from 1.3 percentage points

to 1.1 percentage point. In the Atlanta-only regression, the effect falls from 2 percentage points to 1.9 percentage point. In both cases the effect is still highly statistically significant. And once again, there is no discernable impact in the precincts outside the Atlanta metro area.

In sum, even when we account for past voting, there is a discernable negative impact on turnout associated with being assigned to a troubled precinct in June of 2020. Next, we can take the information about past electoral participation one step further. If we are worried that urban precincts with long lines in June 2020 happen to be precincts where people typically have a low propensity to vote in primaries or presidential preference elections, we can simply throw out everyone who did not vote in the 2016 elections. Let us analyze *only* those who have demonstrated a past proclivity to vote in primaries by showing up for both the 2016 Presidential Preference Election and the Primary. Was turnout lower in the afflicted 2020 precincts among this group of more habitual voters?

The answer is an unambiguous "yes." In Table 7, I present results of models including all of the control variables, but focusing only on the much smaller sample of individuals who voted in both the 2016 Primary and the presidential preference election. Among this group of prior voters, the impact of living in a troubled precinct in June of 2020 on turnout in June of 2020 is substantially *larger* than among the full universe of individuals in the voter file, which includes a large number of people

who vote only rarely in primaries. If we estimate the model on the full set of prior primary voters from all of Georgia, the estimated impact of living in a precinct with long lines is 3 percentage points. And in the Atlanta area, it is 3.8 percentage points. And when we focus on this smaller sample of recent voters, we see a statistically significant impact of 1.9 percentage points in the non-Atlanta precincts. Recall that the troubled non-Atlanta precincts are largely in the Savannah and Columbus areas.

Table 7: Estimated Marginal Effects from Probit Models of June 2020 Turnout, Past Primary Voters Only

	Entire State				Atlanta Only				Non-Atlanta Only			
	Marginal Effect		Lower CI	Upper CI	Marginal Effect		Lower CI	Upper CI	Marginal Effect		Lower CI	Upper CI
Open after 8	-0.029	***	-0.036	-0.021	-0.038	***	-0.047	-0.029	-0.019	*	-0.033	-0.004
African American	0.076	***	0.071	0.081	0.072	***	0.064	0.079	0.082	***	0.076	0.088
White	0.008	**	0.003	0.013	-0.010	***	-0.017	-0.003	0.027	***	0.020	0.033
Hispanic	-0.060	***	-0.075	-0.044	-0.054	***	-0.075	-0.032	-0.076	***	-0.099	-0.053
Asian/Pacific Islander	-0.022	**	-0.039	-0.005	-0.036	***	-0.059	-0.014	-0.014		-0.041	0.013
Native American	-0.015		-0.051	0.020	-0.072	*	-0.131	-0.012	0.028		-0.012	0.068
Female	0.015	***	0.013	0.017	0.022	***	0.019	0.025	0.011	***	0.009	0.013
Age	0.003	***	0.003	0.003	0.002	***	0.002	0.003	0.003	***	0.003	0.003
Atlanta	0.000		-0.005	0.006								
Log population density	-0.006	***	-0.007	-0.004	-0.002		-0.005	0.002	-0.006	***	-0.008	-0.005
Independent	-0.205	***	-0.330	-0.081	-0.112		-0.279	0.056	-0.292	***	-0.470	-0.115
Observations:	775,210				288,242				486,968			

*** $p < .001$; ** $p < .01$; * $p < .05$

In sum, other things equal, turnout was lower among individuals who were assigned to precincts with long lines in June of 2020 than otherwise-similar individuals assigned to precincts not known to have these problems. This is true even if we control for an individual's demonstrated past interest in voting in similar primaries. And in fact, the negative impact on turnout of living in a troubled precinct

is almost twice as large among those who have demonstrated that interest by showing up in the previous election. In other words, long lines appear to have an especially large impact on habitual voters.

IX. CONCLUSIONS

As Georgia has grown and urbanized in recent decades, its elections have become more competitive, and voter interest and participation have surged. To deal with these increasing demands for electoral participation, Georgia has introduced early voting. However, during the same period, Georgia has reduced the number of in-person Election Day polling places. In urban areas, over-burdened single polling places often serve multiple precincts and thousands of registered voters on Election Day. The June 2020 Primary Election demonstrated that even in the presence of early and absentee options, and even in the midst of a dangerous pandemic, the demand for in-person Election-Day voting is extremely strong, especially among minority communities in urban settings. There is no reason to anticipate that the demand will be weaker in November of 2020. On the contrary, there is little debate that interest in participation in the November 2020 election will be very high, and turnout will likely surpass that of the November 2018 midterm or the June 2020 Primary. In almost every general election, local and national media outlets publicize the long lines and snafus that have characterized Georgia's urban polling places. This was especially true in 2018. Yet none of this has convinced Georgia's voters to abandon

Election-Day voting, and it appears that it also has failed to convince election officials to address, up front, the inevitable long lines that will occur on Election Day. Recent elections have demonstrated over and over again that the demand for in-person voting is strong, and that in many of Georgia's metropolitan neighborhoods, the current resources devoted to in-person voting are insufficient.

A persistent mismatch between resources and voters' demand in Georgia has been evident in local media reports for two decades, and has recently been identified by academic researchers as well. In addition to summarizing existing research, this report has contributed additional, detailed analysis using several sources related to the June 2020 Primary. Consistent with existing research, I verify that the problem of long lines on Election Day is disproportionately found in minority precincts, and that the problem is driven by polling places that serve large numbers of voters from several precincts. Not surprisingly, the problem is also largest in places where relatively large shares of voters prefer to vote in-person on Election Day. I also show that polling places in minority neighborhoods are more likely to be slowed down by the need to process provisional ballots.

I have also shown that precincts experiencing longer lines demonstrated relatively lower levels of turnout, even in a context where statewide turnout was at an all-time high. The broader academic literature suggests that long lines are associated with lower turnout among effected groups not only in the short term—as

voters must leave the line in order to go to work or care for their children—but also in the longer term, as they lose confidence in elections.

Given the nature of the problem outlined in this report, it is unlikely that the November 2020 election in Georgia will go smoothly without significant improvements in Election-Day resources and operations in Georgia's metropolitan counties.

APPENDIX

Additional Regression Tables: Individual-Level Turnout Models Controlling for Past Electoral Participation

	Entire State			
	Marginal Effect		Lower CI	Upper CI
Open after 8	-0.011	**	-0.018	-0.003
African American	0.047	***	0.043	0.051
White	0.042	***	0.038	0.046
Hispanic	-0.006	***	-0.009	-0.002
Asian/Pacific Islander	0.019	***	0.014	0.025
Native American	-0.001		-0.012	0.010
Female	0.048	***	0.046	0.049
Age	0.004	***	0.004	0.004
Atlanta	0.041	***	0.035	0.046
Log population density	-0.009	***	-0.011	-0.008
Independent	-0.120	***	-0.123	-0.117
Voted 2016 Primary	0.276	***	0.272	0.279
Voted 2016 Pres. Pref.	0.238	***	0.233	0.242

Observations: 6,819,856

*** p< .001; ** p <.01; * p<.05

	Atlanta Only			
	Marginal Effect		Lower CI	Upper CI
Open after 8	-0.019	***	-0.028	-0.010
African American	0.050	***	0.045	0.055
White	0.022	***	0.017	0.027
Hispanic	-0.016	***	-0.021	-0.012
Asian/Pacific Islander	0.003		-0.003	0.009
Native American	-0.026	***	-0.041	-0.012
Female	0.060	***	0.059	0.062
Age	0.003	***	0.003	0.003

Log population density	-0.004	*	-0.008	0.000
Independent	-0.099	***	-0.103	-0.095
Voted 2016 Primary	0.263		0.259	0.267
Voted 2016 Pres. Pref.	0.259		0.253	0.265

Observations: 3,300,047

*** p< .001; ** p <.01; * p<.05

	Outside Atlanta			
	Marginal Effect		Lower CI	Upper CI
Open after 8	0.002		-0.010	0.014
African American	0.047	***	0.040	0.053
White	0.061	***	0.056	0.066
Hispanic	-0.005		-0.011	0.001
Asian/Pacific Islander	0.032	***	0.023	0.040
Native American	0.028	***	0.012	0.044
Female	0.034	***	0.033	0.036
Age	0.005	***	0.005	0.005
Log population density	-0.010	***	-0.011	-0.009
Independent	-0.134	***	-0.138	-0.129
Voted 2016 Primary	0.277	***	0.273	0.281
Voted 2016 Pres. Pref.	0.222	***	0.218	0.227

Observations: 3,519,809

*** p< .001; ** p <.01; * p<.05

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It Takes a Village: Peer Effects and Externalities in Technology Adoption, 2020, *American Journal of Political Science* (with Romain Ferrali, Guy Grossman, and Melina Platas). Winner, 2020 Best Conference Paper Award, American Political Science Association Network Section.

Assembly of the LongSHOT Cohort: Public Record Linkage on a Grand Scale, 2019, *Injury Prevention* (with Yifan Zhang, Erin Holsinger, Lea Prince, Sonja Swanson, Matthew Miller, Garen Wintemute, and David Studdert).

Crowdsourcing Accountability: ICT for Service Delivery, 2018, *World Development* 112: 74-87 (with Guy Grossman and Melina Platas).

Geography, Uncertainty, and Polarization, 2018, *Political Science Research and Methods* doi:10.1017/psrm.2018.12 (with Nolan McCarty, Boris Shor, Chris Tausanovitch, and Chris Warshaw).

Handgun Acquisitions in California after Two Mass Shootings, 2017, *Annals of Internal Medicine* 166(10):698-706. (with David Studdert, Yifan Zhang, Rob Hyndman, and Garen Wintemute).

Cutting Through the Thicket: Redistricting Simulations and the Detection of Partisan Gerrymanders, 2015, *Election Law Journal* 14,4:1-15 (with Jowei Chen).

The Achilles Heel of Plurality Systems: Geography and Representation in Multi-Party Democracies, 2015, *American Journal of Political Science* 59,4: 789-805 (with Ernesto Calvo). Winner, Michael Wallerstein Award for best paper in political economy, American Political Science Association.

Why has U.S. Policy Uncertainty Risen Since 1960?, 2014, *American Economic Review: Papers and Proceedings* May 2014 (with Nicholas Bloom, Brandice Canes-Wrone, Scott Baker, and Steven Davis).

Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures, 2013, *Quarterly Journal of Political Science* 8: 239-269 (with Jowei Chen).

How Should We Measure District-Level Public Opinion on Individual Issues?, 2012, *Journal of Politics* 74, 1: 203-219 (with Chris Warshaw).

Representation and Redistribution in Federations, 2011, *Proceedings of the National Academy of Sciences* 108, 21:8601-8604 (with Tiberiu Dragu).

Dual Accountability and the Nationalization of Party Competition: Evidence from Four Federatons, 2011, *Party Politics* 17, 5: 629-653 (with Erik Wibbels).

The Geographic Distribution of Political Preferences, 2010, *Annual Review of Political Science* 13: 297–340.

Fiscal Decentralization and the Business Cycle: An Empirical Study of Seven Federations, 2009, *Economics and Politics* 22,1: 37–67 (with Erik Wibbels).

Getting into the Game: Legislative Bargaining, Distributive Politics, and EU Enlargement, 2009, *Public Finance and Management* 9, 4 (with Deniz Aksoy).

The Strength of Issues: Using Multiple Measures to Gauge Preference Stability, Ideological Constraint, and Issue Voting, 2008. *American Political Science Review* 102, 2: 215–232 (with Stephen Ansolabehere and James Snyder).

Does Religion Distract the Poor? Income and Issue Voting Around the World, 2008, *Comparative Political Studies* 41, 4: 437–476 (with Ana Lorena De La O).

Purple America, 2006, *Journal of Economic Perspectives* 20,2 (Spring): 97–118 (with Stephen Ansolabehere and James Snyder).

Economic Geography and Economic Voting: Evidence from the U.S. States, 2006, *British Journal of Political Science* 36, 3: 527–47 (with Michael Ebeid).

Distributive Politics in a Federation: Electoral Strategies, Legislative Bargaining, and Government Coalitions, 2004, *Dados* 47, 3 (with Marta Arretche, in Portuguese).

Comparative Federalism and Decentralization: On Meaning and Measurement, 2004, *Comparative Politics* 36, 4: 481-500. (Portuguese version, 2005, in *Revista de Sociologia e Politica* 25).

Reviving Leviathan: Fiscal Federalism and the Growth of Government, 2003, *International Organization* 57 (Fall), 695–729.

Beyond the Fiction of Federalism: Macroeconomic Management in Multi-tiered Systems, 2003, *World Politics* 54, 4 (July): 494–531 (with Erik Wibbels).

The Dilemma of Fiscal Federalism: Grants and Fiscal Performance around the World, 2002, *American Journal of Political Science* 46(3): 670–687.

Strength in Numbers: Representation and Redistribution in the European Union, 2002, *European Union Politics* 3, 2: 151–175.

Does Federalism Preserve Markets? *Virginia Law Review* 83, 7 (with Susan Rose-Ackerman). Spanish version, 1999, in *Quorum* 68.

Working Papers

Federalism and Inter-regional Redistribution, Working Paper 2009/3, Institut d'Economia de Barcelona.

Representation and Regional Redistribution in Federations, Working Paper 2010/16, Institut d'Economia de Barcelona (with Tiberiu Dragu).

Chapters in Books

Decentralized Rule and Revenue, 2019, in Jonathan Rodden and Erik Wibbels, eds., *Decentralized Governance and Accountability*, Cambridge University Press.

Geography and Gridlock in the United States, 2014, in Nathaniel Persily, ed. *Solutions to Political Polarization in America*, Cambridge University Press.

Can Market Discipline Survive in the U.S. Federation?, 2013, in Daniel Nadler and Paul Peterson, eds, *The Global Debt Crisis: Haunting U.S. and European Federalism*, Brookings Press.

Market Discipline and U.S. Federalism, 2012, in Peter Conti-Brown and David A. Skeel, Jr., eds, *When States Go Broke: The Origins, Context, and Solutions for the American States in Fiscal Crisis*, Cambridge University Press.

Federalism and Inter-Regional Redistribution, 2010, in Nuria Bosch, Marta Espasa, and Albert Sole Olle, eds., *The Political Economy of Inter-Regional Fiscal Flows*, Edward Elgar.

Back to the Future: Endogenous Institutions and Comparative Politics, 2009, in Mark Lichbach and Alan Zuckerman, eds., *Comparative Politics: Rationality, Culture, and Structure* (Second Edition), Cambridge University Press.

The Political Economy of Federalism, 2006, in Barry Weingast and Donald Wittman, eds., *Oxford Handbook of Political Economy*, Oxford University Press.

Fiscal Discipline in Federations: Germany and the EMU, 2006, in Peter Wierts, Servaas Deroose, Elena Flores and Alessandro Turrini, eds., *Fiscal Policy Surveillance in Europe*, Palgrave MacMillan.

The Political Economy of Pro-cyclical Decentralised Finance (with Erik Wibbels), 2006, in Peter Wierts, Servaas Deroose, Elena Flores and Alessandro Turrini, eds., *Fiscal Policy Surveillance in Europe*, Palgrave MacMillan.

Globalization and Fiscal Decentralization, (with Geoffrey Garrett), 2003, in Miles Kahler and David Lake, eds., *Governance in a Global Economy: Political Authority in Transition*, Princeton University Press: 87-109. (Updated version, 2007, in David Cameron, Gustav Ranis, and Annalisa Zinn, eds., *Globalization and Self-Determination: Is the Nation-State under Siege?* Routledge.)

Introduction and Overview (Chapter 1), 2003, in Rodden et al., *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

Soft Budget Constraints and German Federalism (Chapter 5), 2003, in Rodden, et al, *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

Federalism and Bailouts in Brazil (Chapter 7), 2003, in Rodden, et al., *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

Lessons and Conclusions (Chapter 13), 2003, in Rodden, et al., *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (see above).

Online Interactive Visualization

Stanford Election Atlas, 2012 (collaboration with Stephen Ansolabehere at Harvard and Jim Herries at ESRI)

Other Publications

How America's Urban-Rural Divide has Shaped the Pandemic, 2020, *Foreign Affairs*, April 20, 2020.

An Evolutionary Path for the European Monetary Fund? A Comparative Perspective, 2017, Briefing paper for the Economic and Financial Affairs Committee of the European Parliament.

Representation and Regional Redistribution in Federations: A Research Report, 2009, in *World Report on Fiscal Federalism*, Institut d'Economia de Barcelona.

On the Migration of Fiscal Sovereignty, 2004, *PS: Political Science and Politics* July, 2004: 427–431.

Decentralization and the Challenge of Hard Budget Constraints, *PREM Note* 41, Poverty Reduction and Economic Management Unit, World Bank, Washington, D.C. (July).

Decentralization and Hard Budget Constraints, *APSA-CP* (Newsletter of the Organized Section in Comparative Politics, American Political Science Association) 11:1 (with Jennie Litvack).

Book Review of *The Government of Money* by Peter Johnson, *Comparative Political Studies 32,7: 897-900.*

Fellowships and Honors

Fund for a Safer Future, Longitudinal Study of Handgun Ownership and Transfer (LongSHOT), GA004696, 2017-2018.

Stanford Institute for Innovation in Developing Economies, Innovation and Entrepreneurship research grant, 2015.

Michael Wallerstein Award for best paper in political economy, American Political Science Association, 2016.

Common Cause Gerrymandering Standard Writing Competition, 2015.

General support grant from the Hewlett Foundation for Spatial Social Science Lab, 2014.

Fellow, Institute for Research in the Social Sciences, Stanford University, 2012.

Sloan Foundation, grant for assembly of geo-referenced precinct-level electoral data set (with Stephen Ansolabehere and James Snyder), 2009-2011.

Hoagland Award Fund for Innovations in Undergraduate Teaching, Stanford University, 2009.

W. Glenn Campbell and Rita Ricardo-Campbell National Fellow, Hoover Institution, Stanford University, beginning Fall 2010.

Research Grant on Fiscal Federalism, Institut d'Economia de Barcelona, 2009.

Fellow, Institute for Research in the Social Sciences, Stanford University, 2008.

United Postal Service Foundation grant for study of the spatial distribution of income in cities, 2008.

Gregory Luebbert Award for Best Book in Comparative Politics, 2007.

Fellow, Center for Advanced Study in the Behavioral Sciences, 2006-2007.

National Science Foundation grant for assembly of cross-national provincial-level dataset on elections, public finance, and government composition, 2003-2004 (with Erik Wibbels).

MIT Dean's Fund and School of Humanities, Arts, and Social Sciences Research Funds.

Funding from DAAD (German Academic Exchange Service), MIT, and Harvard EU Center to organize the conference, "European Fiscal Federalism in Comparative Perspective," held at Harvard University, November 4, 2000.

Canadian Studies Fellowship (Canadian Federal Government), 1996-1997.

Prize Teaching Fellowship, Yale University, 1998-1999.

Fulbright Grant, University of Leipzig, Germany, 1993-1994.

Michigan Association of Governing Boards Award, one of two top graduating students at the University of Michigan, 1993.

W. J. Bryan Prize, top graduating senior in political science department at the University of Michigan, 1993.

Other Professional Activities

International Advisory Committee, Center for Metropolitan Studies, Sao Paulo, Brazil, 2006–2010.

Selection committee, Mancur Olson Prize awarded by the American Political Science Association Political Economy Section for the best dissertation in the field of political economy.

Selection committee, Gregory Luebbert Best Book Award.

Selection committee, William Anderson Prize, awarded by the American Political Science Association for the best dissertation in the field of federalism and intergovernmental relations.

Courses

Undergraduate

Politics, Economics, and Democracy

Introduction to Comparative Politics

Introduction to Political Science

Political Science Scope and Methods

Institutional Economics

Spatial Approaches to Social Science

Graduate

Political Economy of Institutions

Federalism and Fiscal Decentralization

Politics and Geography

Consulting

2017. Economic and Financial Affairs Committee of the European Parliament.

2016. Briefing paper for the World Bank on fiscal federalism in Brazil.

2013-2018: Principal Investigator, SMS for Better Governance (a collaborative project involving USAID, Social Impact, and UNICEF in Arua, Uganda).

2019: Written expert testimony in *McLemore, Holmes, Robinson, and Woullard v. Hosemann*, United States District Court, Mississippi.

2019: Expert witness in *Nancy Corola Jacobson v. Detzner*, United States District Court, Florida.

2018: Written expert testimony in *League of Women Voters of Florida v. Detzner* No. 4:18-cv-002510, United States District Court, Florida.

2018: Written expert testimony in *College Democrats of the University of Michigan, et al. v. Johnson, et al.*, United States District Court for the Eastern District of Michigan.

2017: Expert witness in *Bethune-Hill v. Virginia Board of Elections*, No. 3:14-CV-00852, United States District Court for the Eastern District of Virginia.

2017: Expert witness in *Arizona Democratic Party, et al. v. Reagan, et al.*, No. 2:16-CV-01065, United States District Court for Arizona.

2016: Expert witness in *Lee v. Virginia Board of Elections*, 3:15-cv-357, United States District Court for the Eastern District of Virginia, Richmond Division.

2016: Expert witness in *Missouri NAACP v. Ferguson-Florissant School District*, United States District Court for the Eastern District of Missouri, Eastern Division.

2014-2015: Written expert testimony in *League of Women Voters of Florida et al. v. Detzner, et al.*, 2012-CA-002842 in Florida Circuit Court, Leon County (Florida Senate redistricting case).

2013-2014: Expert witness in *Romo v Detzner*, 2012-CA-000412 in Florida Curcuit Court, Leon County (Florida Congressional redistricting case).

2011-2014: Consultation with investment groups and hedge funds on European debt crisis.

2011-2014: Lead Outcome Expert, Democracy and Governance, USAID and Social Impact.

2010: USAID, Review of USAID analysis of decentralization in Africa.

2006–2009: World Bank, Independent Evaluations Group. Undertook evaluations of World Bank decentralization and safety net programs.

2008–2011: International Monetary Fund Institute. Designed and taught course on fiscal federalism.

1998–2003: World Bank, Poverty Reduction and Economic Management Unit. Consultant for *World Development Report*, lecturer for training courses, participant in working group for assembly of decentralization data, director of multi-country study of fiscal discipline in decentralized countries, collaborator on review of subnational adjustment lending.

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